SCIENTIFIC AMERICAN

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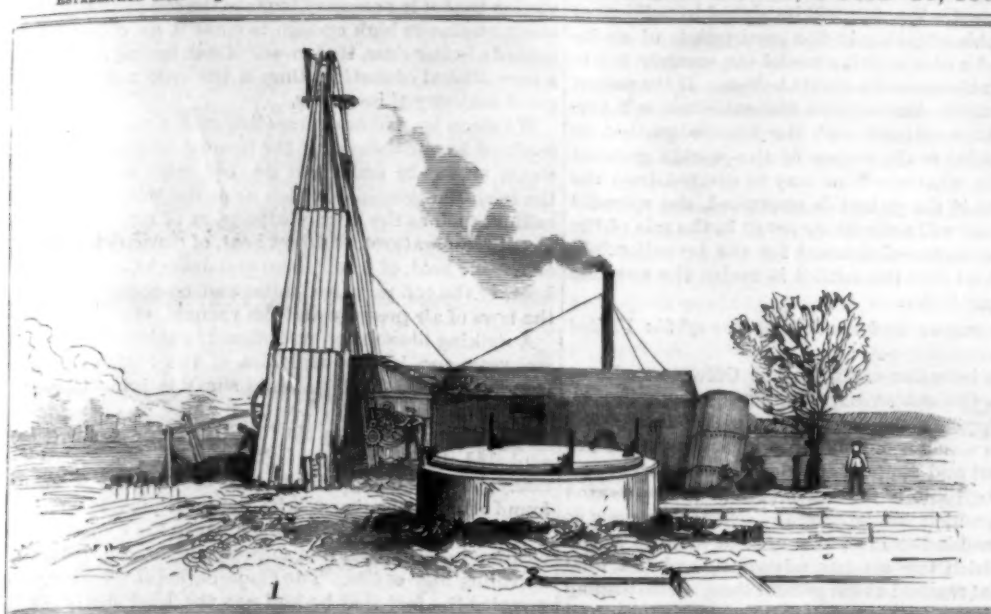

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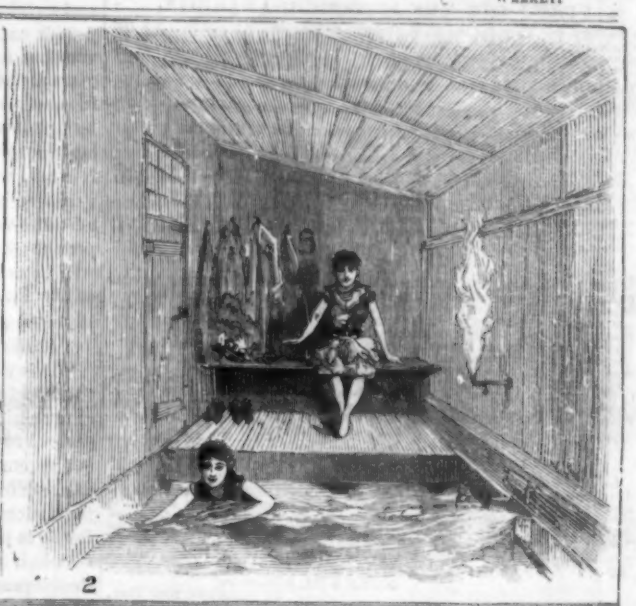

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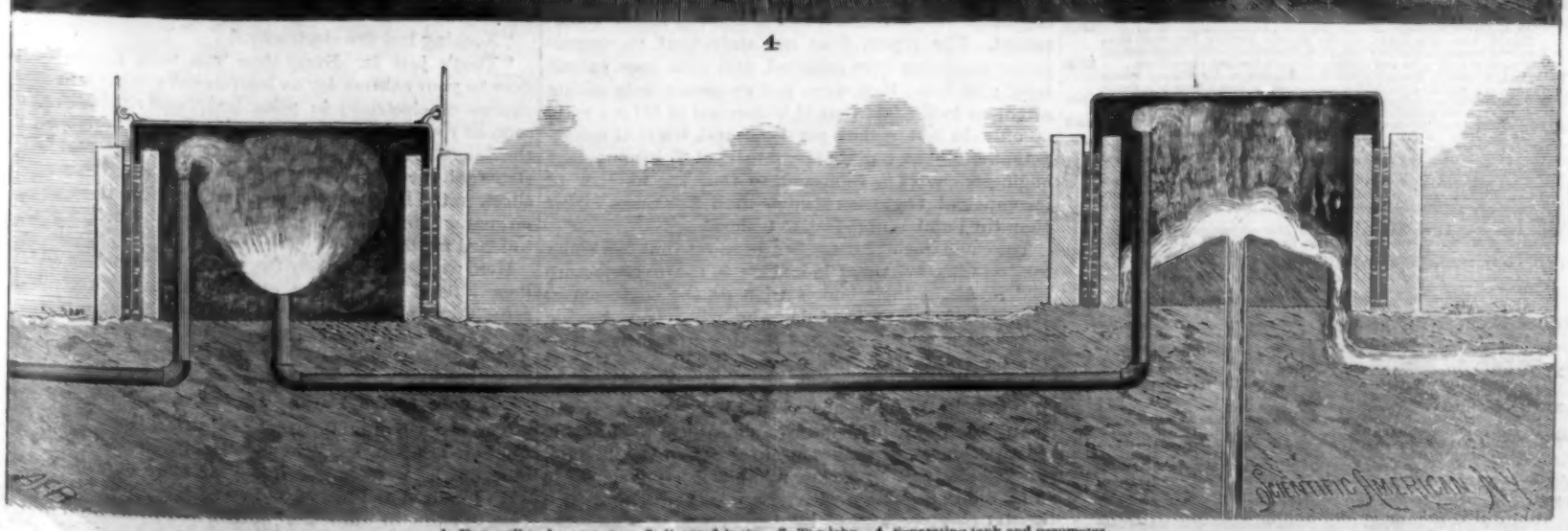

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Scientific American.

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NEW YORK, SATURDAY, JULY 23, 1892.

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(Illustrated articles are marked with an asterisk.)

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No. 864.

For the Week Ending July 23, 1892.

Price 10 cents. For sale by all newsdealers.

INVENTORS AT THE WORLD'S FAIR.

The invitation to inventors, by the Commissioner of Patents, published below, is taken from the *Official Gazette*, and is self-explanatory.

This invitation should be generally accepted by inventors, as it enables them to contribute to the success of the fair, and at the same time gives them an opportunity to advertise such as occurs but once in a lifetime. Many inventors cannot afford to make individual exhibits at the fair, but this arrangement for exhibiting models gives them practically the same chance to show their inventions that they would have if exhibiting individually, as each model will be labeled and catalogued. The fair will be visited by millions of people capable of taking in the good points of an invention, and a nice working model can scarcely fail to attract the attention of possible buyers. If the patent for the invention has expired, the exhibitor will perhaps have to be satisfied with the knowledge that he has contributed to the success of the world's greatest fair and with whatever fame may be derived from the exhibit; but if the patent is unexpired, the splendid advertisement will quite likely result in the sale of the patent or an increased demand for the invention. It will be noticed that the exhibit is under the auspices of the Patent Office.

"*To the inventors and manufacturers of the United States:*

"It is the intention of the Patent Office to make at the World's Columbian Exposition at Chicago, in 1893, an exhibit which will show that great advance in the several arts which is due, in large measure, to the encouragement and support afforded by our patent system. This exhibit is to consist of models of patented inventions, which will be carefully selected, to show as far as is possible the inception of each art, the stages through which the art has advanced, and the final development reached at the present time. This display of typical inventions, embodied in concrete form and properly arranged, will, it is believed, constitute a grand historical exhibit of the progress of the useful arts and one which will be of great interest not only to inventors and manufacturers, but to the public generally.

"The Office collection of models has been seriously impaired by fire, and is further incomplete by reason of the fact that models have not generally been required or received during the last ten years. The Office is not, therefore, in possession of the models of many valuable inventions which might properly be included in such an exhibit, and without which, indeed, the exhibit would be incomplete. The limited appropriation for this exhibit will not permit the Office to make such models. An urgent appeal is therefore made to all inventors and manufacturers to come to the assistance of the Office in this matter, either by loans of models already built or by the construction of such models not in the possession of the Office as should properly be placed in such a collection. Of course, where models are loaned to the Office all proper credit will be given both in labels and catalogues to the parties by whom the loans are made, and such disposition will be made of the models after the close of the exhibit as the owners shall direct. Many inventors and manufacturers have already indicated a willingness to co-operate with the Office in this matter, and it is confidently expected that such a response will be made to this general appeal as will assure the unparalleled success of this attempt to graphically and concretely show the development of American invention.

W. E. SIMONDS, Commissioner."

DEFECTIVE BOILERS AND INCOMPETENT ENGINEERS.

The official quarterly report of William S. Powers, Superintendent of Steam Boilers, to Police Commissioner Hayden, of Brooklyn, N. Y., shows that from April 1 to June 30, 667 steam boilers were examined in that city, of which 11 were condemned, removed, and good boilers substituted. It states further that 612 engineers were examined, and of these 51 found incompetent. The report does not state that the incompetent engineers were removed, and able ones substituted; we trust they were, but we cannot help calling attention to the fact that 11 boilers out of 667 is a ratio of only 16 bad boilers per thousand, while 51 incompetent engineers out of 612 is a ratio of 83 incompetent engineers out of a thousand, so that the number of incompetent engineers is more than five times larger than the number of defective boilers.

The comparison of these figures shows that the boiler makers take five times more care in the manufacture and repair of their boilers than do the engineers in trying to learn their trade, who, when once having obtained employment, need looking after, as well as the boilers, in fact, five times more so, according to discovered ratio of capability for duty. In addition to this it must be remembered that boilers, being inanimate objects, are in themselves not subject to blunders, to carelessness, to strikes nor to drunkenness, in fact, possess in this regard reliability equivalent to infallibility compared with the weaknesses and incidental shortcomings of human beings, of which the futility has become proverbial.

If this quarterly report is the average of every three months for the whole year, then there are 44 worthless boilers condemned per year, while the number of engineers proved to be incompetent for the performance of their duties is not less than 482, to which life and property are intrusted. It proves, also, that in regard to the causes of the many boiler explosions reported in the newspapers from time to time, at least *five* are due to incompetent engineers, against *one* by incompetence of the boiler itself, of which the practical strength is only equal to the weakest part thereof.

Matters will only grow better in this regard when owners and managers of steam power come to the conviction that it is necessary to place the compensation of steam engineers high enough to make it an object for men of a better class, that means of men having received a more liberal education, than is the case now in the great majority of instances.

We mean by a liberal education such a one as is not confined to understanding the manual treatment of a steam engine in making it go, but who understand the scientific principles which lie at the basis of their calling, such as the laws of expansion of steam at different temperatures, of latent heat, of capacity for heat or specific heat, of combustion and draught, of units of heat, of the comparative value and economy of fuel, the laws of air pressure and the vacuum, etc.

A striking illustration was offered in this respect several years ago, in the explosion of the Staten Island ferryboat Westfield, 1871, while she was lying in her slip. She was crowded with Sunday excursionists, when, a moment before starting, her very large boiler exploded, lifting up her deck, with disastrous result, many persons being killed. At the inquest it was found that the engineer, who was a colored, illiterate man, advanced from being a stoker to the responsible position he occupied, was entirely responsible for the appalling loss of life. The examination at the inquest revealed the fact that he had not the least idea of the air pressure or a vacuum, of which he had never heard, that he supposed that when he kept the boiler entirely full of water it was all right, etc.

Carpet Electricity.

The exact similarity in conditions attending the repetition of experiments is a great element of success. One should be very careful before coming to a conclusion that his premises are correct. A striking example of this was recently presented to my notice.

A dentist came into my laboratory the other day and said:

"See here, I can't, for the life of me, understand what is the matter with me. All my patients complain that when I first put an instrument into their mouths it pains them fearfully. I've thought it all over, and have come to the conclusion that my instruments must be magnetized or bewitched, or I am. I've brought over some of them to have them examined. Just let me show you what I mean. Have you got a sensitive tooth?"

I pointed to a molar then under process of repair. He unwrapped some of his instruments, and selecting one, gently inserted it into my open mouth and touched the filling in my tooth. All I felt was the instrument touching the filling. I experienced no pain.

"Good heavens, man!" said he, "what nerve you have. What fortitude. What—"

"Nonsense," I exclaimed, "I didn't feel anything."

"Well," said he, looking puzzled, "you are the first man that hasn't yelled when I touched his tooth since I moved into my new office. I can't understand it."

I told him I would come around to his office in the afternoon and see if I could find out what was the matter.

Later in the day I called to see him.

"Well, have you got it yet?" he asked, as he walked across the carpet and shook hands with me.

"I hadn't one second ago," I answered, "but I have now. Did you notice what happened when you shook hands with me?"

"Nothing but the electricity."

"That's just it. Every time you walk across the floor to your cabinet for an instrument you get a small charge of electricity in your body, and naturally, as soon as you touch the sensitive tooth of the patient, the delicate nerve received the charge through your instrument—hence the pain. The reason why I felt no shock in the laboratory was simply because there was no carpet for you to rub your feet on before you touched my tooth."

Here we see that merely the want of a carpet on the floor altered entirely the conditions for a successful repetition of an experiment that had apparently no connection with the presence of a carpet.—*Julian A. Moses, Electrical Review.*

Cart Horse Parade in Regent's Park.

The seventh annual parade of the Cart Horse Parade Society, London, was held recently in Regent's Park. The entries were larger this year than ever before. Five hundred and forty-two horses, including 384 singles, 56 pairs, 10 "unicorn" teams, and 4 teams of four, were present.

The Great Tin Mines of Dakota.

During the last four years a small company of gentlemen have privately contributed means to secure and occupy all the available claims for tin mining in the vicinity of Harney Peak, Dakota. They have studiously avoided publicity in the matter until their purchases, which have been very extensive, were complete. They have been greatly aided by the outcry and claptrap of the newspapers to the effect that there were no tin mines in this country worth having. Meantime they have gone ahead with their explorations and searches, and their efforts have been crowned with success. Many rich claims have been secured. A large company has been financed. Some idea of the magnitude of this property and the abundance of the metal may be gathered from the following report of an interview with one of the officers of the company given recently in the New York *Press*.

Lord Thurlow, of London, who was paymaster-general in Gladstone's last cabinet, sailed June 18 on the City of New York. He has recently returned from a visit to the tin mine properties in South Dakota, where the Harney Peak Consolidated Tin Mining and Milling Company, with a capital of $15,000,000, of which he is an officer, owns 1,100 claims.

"This country," said Lord Thurlow, "will not need to import any tin two years hence, for our mines will produce enough tin to last for centuries. The production will save $75,000,000 a year, which this country is paying for tin plate. This enormous sum will go into the hands of the people of this country.

"The company, of which I am the chairman, and in which New York or American capitalists are equally interested, has already built two of the largest and most thoroughly equipped mills in the world. Each has a capacity to produce 500 tons of tin a day, and this will be increased to 3,000 tons daily should necessity demand it.

"Two or three other mills of similar proportions have been planned. We expect to begin to work the two mills already constructed by October 1, and to put tin on the market in commercial quantities. I have inspected tin-mining properties in various countries, but I never yet saw such resources as I found in Dakota."

The Flame of Burning Nitrogen.

BY W. CROOKES, F.R.S.

Nitrogen is a combustible gas; that is to say, a mixture of nitrogen and oxygen (atmospheric air) will under certain conditions burn with a flame, and production of nitrous and nitric acids. The reason why, when once nitrogen is set on fire, the flame does not spread throughout the whole atmosphere and deluge the world in a sea of nitric acid is that the igniting point of nitrogen is higher than the temperature produced by its combustion, and therefore the flame is not hot enough to set fire to the adjacent gas.

In the experiment shown at the *soirée* of the Royal Society on June 15, an electric current of 65 volts and 15 amperes, alternating 130 times a second, was passed through the primary of a large induction coil, when an arching flame, consisting chiefly of burning nitrogen, issued from each of the secondary poles, meeting at the center. When once started the poles can be drawn asunder till the flame bridges across 212 mm. When the terminals are more than 46 mm. apart, the flame will not strike across. When alight the flame is easily blown out by the breath, and it can then be relighted by a taper.

In the spectroscope the flame of nitrogen shows no lines, the spectrum being faint and continuous. The temperature is a little higher than that of a good blow pipe flame, easily melting fine platinum wire. The gases rising from a flame have a strong odor of nitrous acid, and when it is produced in a closed globe, the interior rapidly fills with red gases.

The flame produced by exciting an induction coil by means of an alternating current was first observed by Mr. Spottiswoode, F.R.S., who described it before the Royal Society in 1880. It has lately been exhibited on a magnificent scale at the Crystal Palace, by Messrs. Siemens Bros., and by Messrs. Swinburne & Co. It is not known, however, that any chemical explanation of the flame has before now been published.—*Chemical News.*

Effects of Lightning.

M. Boens gives an account in the Belgian medical *Bulletin* of two young women who were struck by lightning on July 27, 1891, at Nalinnes, Namur, during a violent storm. They were taken to the village doctor, who treated them continuously for two hours, when signs of returning life were seen, and at three o'clock next morning consciousness of both returned, one being soon well, but the other being left with a profound sciatica. Her tongue was also paralyzed for two months, but both eventually recovered. The moral which M. Boens justly emphasizes is that efforts to revive those struck by lightning should not too soon be given up, as continuous attempts to restore respiration during several hours may result in return of life.

The Turret Ship Miantonomoh.

The recent cruise of the United States steamer Miantonomoh to Annapolis, Md., and return, says the New York *Herald*, was a success in this, that it brought to light all the good and bad qualities of this type of vessel, and she will now serve as an object lesson in the construction of other ships of her class. One fact seems to have been clearly demonstrated to the thorough satisfaction of all on board, and that is that monitors should not be sent to sea, except so far as is necessary in going from one port to another.

There are two very good reasons for this statement—first, because of the absolute inability to fight her guns at sea, and second, because of the great discomfort and positive danger to the health of all on board.

It will be remembered from previous accounts of the ship that the muzzle of the guns when leveled are only about five feet above the water line. Now, if the ship were a steady platform, which simply rose and fell with the waves or swell, this would be all right, but such is not the case.

In an ordinary ground swell or moderate sea, such as was encountered going down along the coast, the ship rolled from 10 to 15 degrees, shipping a sea with every roll, which dashed completely over the turrets, and which would have wholly buried the muzzle of the guns if they had been trained level abeam or even at an elevation, filling the guns with water and thus preventing their being fired.

Another reason why the guns cannot be used at sea is that in order to fire them the turrets must be available, which is not the case under the present conditions.

Upon going to sea four heavy brass chocks are inserted between the turret and the deck around each turret. Then the apron over this space is screwed down tight and all the joints are calked and filled with paraffine and a wooden batten is nailed over all, thus effectually securing the turret both from revolving and from working from side to side. Besides this, heavy wooden port bucklers are put around the chase of the guns over the ports and the space between is thoroughly calked. All these things are absolutely necessary to prevent the berth deck from being flooded, and even they are not sufficient. A considerable length of time is necessary to remove these, and they must all be removed in order to use either the guns or the turrets.

The second reason why the ships of the monitor type should not be sent to sea—the discomfort of all hands—can scarcely be imagined unless it has been seen. Notwithstanding all the efforts that have been made to prevent the water from gaining access to the berth deck, sufficient water gets below to make every place damp or wet and leaves no place for the men to rest below.

Furthermore, all the hatches have to be closed and battened down immediately on leaving smooth water, and the heat from the engine and fire rooms raises the temperature of the turret chambers to from 90° to 100° Fah., making it almost impossible for any one to remain below. The artificial ventilation, although far superior to that on the old monitors, is not sufficient to carry off the hot air and supply its place with fresh cool air from above.

In the turret chambers themselves there are no exhaust ventilators, so that although fresh air is being constantly forced in, it soon becomes as heated as that already there. No one can remain on the spar deck while at sea, as every wave washes completely over the deck, several feet deep, breaking over the turrets and throwing the spray high over the forward bridge. Even while lying at anchor in Chesapeake Bay seas came aboard, washing over the high hatch combings and necessitating the closing of everything fore and aft. The only place left for the men to stay is the hurricane deck, which being small and the space largely filled up with chests, hatches, ventilators and the smokestack, is very crowded and uncomfortable when nearly 100 men get on it.

But the people of the engineer's force have a much harder time than the deck hands. The temperature of the engine room ranges from 120 to 135 degrees, while that of the fire room is generally about 145. The ventilation of the fire room is fair, while that of the engine room is almost nothing. The machinists and engineers have to stand on the hot iron platform above the engines in order to control the reversing gear and valves, and there is scarcely room enough above them to allow them to stand erect between the beams. After standing a four hour watch in such a place it is absolutely necessary for the men to have some place to go for rest and fresh air, but, as has been seen, this is very hard to find. Consequently a number of the men have been prostrated and utterly unable to continue their work.

No one questions the ability of the ship to go to sea as far as her seaworthiness is concerned, but it is certainly considered useless to subject every one on board to such discomforts, especially when she could never be of any service in a fight at sea.

A number of changes will be recommended which, if carried out, will greatly improve the comfort of all hands. Some of these will be to increase the ventilation by adding more blowers, by cutting a large hatch over the engine room and by putting in ventilators in different parts of the ship.

A Large Projectile Wrecks a Schooner.

The schooner Henry B. Tilton was recently wrecked off the United States Army Ordinance Proving Grounds, at Sandy Hook, by a 575 pound projectile, which went astray after leaving the muzzle of a 10-in. breech-loading rifled cannon. The projectile struck the vessel on the starboard counter, crashed through her longitudinally as if she were an eggshell, and before the crew realized that the craft had been struck, the water poured in through a great splintered hole in her port bow, where the shot had emerged. Her seams are wide open everywhere, and she now lies on her beam ends a wreck. All hands were saved. The wreck of this vessel presents a novel illustration of the terribly destructive force of the gun. She was sailing along at a distance of four miles from the shore when the shot struck her. The officers in charge of the gun express ignorance of the affair. They did not see any vessel in front of the gun at the time of firing, and how the shot could have traveled off sidewise to embowel an innocent sailing vessel is more than they can understand.

Population by Color, Sex, and General Nativity, 1890.

The distribution of population by color, sex, and general nativity in 1890, by States and Territories, and for the United States as a whole, is given in Census Bulletin No. 194.

The primary results of this first detailed count of population, according to the returns made under the eleventh census, are given as follows:

Aggregate population	62,622,250
Males	32,067,880
Females	30,554,370
Native born	53,372,703
Foreign born	9,249,547
White	54,983,890
Colored	7,638,360

Of the total population returned in 1890, 51·21 per cent are males and 48·79 per cent are females.

The very large excess of males in 1890 is readily accounted for by the greatly increased number of immigrants who have come to this country since 1880, over three-fifths of the entire number of immigrants being males.

Analyzing the results of the distribution of population according to native and foreign born, it is seen that 14·77 per cent of the population in 1890 are foreign born, as against 13·32 per cent in 1880, and 9·68 per cent in 1850. The native born in 1850 represented 90·32 per cent of the whole population, while in 1890 they represented 85·23 per cent.

The colored element of our population, including Chinese, Japanese, and civilized Indians, as well as persons of African descent, represents 12·20 per cent of the population in 1890, as against 15·69 per cent in 1850. The relatively decreased per cent of colored in 1870, as compared with 1860 and also with 1880, is due to the deficient census of 1870 in the Southern States.

An Alloy Resembling Gold.

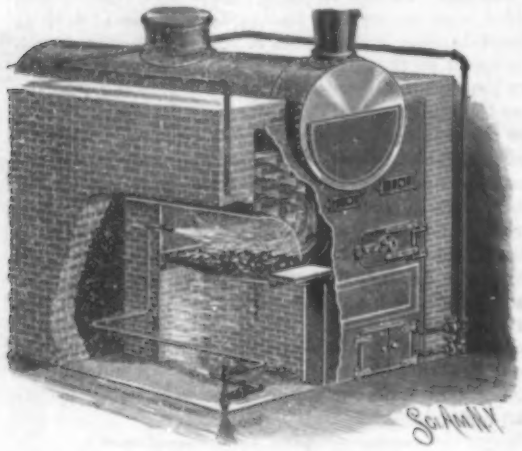
This alloy, by the Menden Works, might be substituted for gold, not only because of its color, but also by reason of certain properties that it possesses. It remains unalterable, without any modification of its color, even after having been exposed for a long time to air containing ammoniacal or acid vapors. It can be rolled and worked like gold, and has the aspect of this metal without containing the least particle of it. This new alloy is also much less costly than those that are usually employed in place of the precious metals. It consists of copper and antimony in the proportion of about 100 to 6. It is prepared by adding the desired quantity of antimony to the copper melted and heated to a certain temperature. After the antimony is melted and intimately mixed with the copper, a little charcoal, magnesium, and calcspar is added to the crucible. This flux has the effect of causing the disappearance of a porous structure which the material would not lose without that, and of furnishing a very compact cast metal. The latter can then be rolled, beaten, hammer-hardened, and soldered, like gold, and, after being polished, it has the aspect of genuine gold, while its solidity is much greater than that of the latter.—*Moniteur Scientifique, from the Metallarbeiter.*

Height of Auroras.

Experiments made at the Royal Danish Academy have demonstrated approximately the height of the aurora borealis. M. Adam Paulsen, at Godthaab, by means of two theodolites situated four miles apart, found that different aurora displays varied from one to four miles in height. Experiments near Cape Farewell showed the height of different auroras to vary from one to ten miles. At Spitzenberg the range of height was from one-third to eighteen miles. In some of the earlier experiments in this direction the observers concluded that the height of auroras varied from 90 to 500 miles.

AN IMPROVED BOILER FURNACE.

The furnace shown in the accompanying illustration has a novel form of checker brickwork forming flues over the firebox and under the boiler, and is arranged for the discharge of steam in the firebox and under the grate to promote perfect combustion and insure a very high temperature. This improvement has been patented by Mr. Walter Hurdley, of Youngstown, Ohio.



HURDLEY'S BOILER FURNACE.

Although only one furnace is shown, any number of fireboxes may be arranged side by side in the brickwork, each of the fireboxes having a closed rear end and a semicircular top, the front open end of the firebox discharging into a space whose front portion is closed by the usual front of the boiler, while the top of the space communicates with the brickwork flues, which extend the length of the firebox. Behind the rear wall of the latter is an open space under the boiler, and to the rear of this space is a bridge wall, at the top of which are other similar checker brickwork flues leading to the rear of the boiler, whence the gases and products of combustion travel forward in the draught flues of the boiler to the chimney or smokestack. At the front of the furnace, directly above each filling opening, are draught openings closed by suitable dampers, and steam pipes from the boiler, controlled by valves at the side of the ashpit door, are arranged to discharge into the ashpit and firebox as shown. In starting the fire the ashpit doors are open, but when the firebox, which is preferably of metal, has reached a cherry-red heat, the ashpit doors are closed and the upper damper doors opened, at which time also the valves are opened for the discharge of steam under the grate and over the burning fuel. This style of boiler furnace is designed to be very effective for a wide variety of purposes, for use in connection with marine and stationary engines, etc.

A SALT SPRINKLER FOR TABLE USE.

A salt sprinkler designed to obviate the difficulty so frequently experienced in use from the salt becoming damp and caking is shown in the accompanying illustration. The improvement has been patented by Mr. F. N. Dixon, of No. 1611 Brown Street, Philadelphia, Pa. As shown in the sectional view, a follower and a spiral spring are contained within the holder. The spring is secured to the bottom and follower respectively, and operates to force the follower upward, to support the mass of salt, whatever its quantity, against and in contact with the cap. The cap is permanently swiveled upon the body so as to freely rotate upon it, having in the form illustrated a circumferential flange engaging a similar flange on the body. The cap may also be provided with small downwardly turned cutting edges. To operate the device, it is inverted and held with one hand, and the cap rotated backward and forward with the thumb and finger of the other hand. In such rotation or working the cap perforations and edges exert a positive grinding or shearing action upon the surface of the mass pressed against them, so that each movement of the cap compels a given quantity of salt to drop through the perforations. The bottom is secured to the body by a screw thread, and may be removed, together with the connected spring and follower, to fill the sprinkler.

IMPROVED STEAM WHISTLES.

In the steam whistle shown in Fig. 1 the central stem is done away with, and instead of the usual square top with acorn, is a dome-shaped top. The bell or tube is securely fastened at its lower end to a three-armed prong or spider, the stem of which is threaded to admit of being screwed into the base and there held secure by a jam nut. Owing to this construction the lower edge of the bell is always exactly in line with the slot in the base through which the stem escapes, insuring the best results and a perfect, clear, and loud tone. The bell can be raised and lowered to suit the steam pressure by screwing it up or down, and when properly set is fastened by the jam nut. It has been proved by practical tests that the prongs to which the bell is fastened do not interfere with the volume or quality of the sound.

In the combination or fire alarm whistle, shown in Fig. 2, a valve is already attached, making it very compact and simple. It is provided with a piston that can be moved up or down within the bell or tube, thus changing the interior length of same and consequently also the sound of the whistle. When the piston is not operated the whistle gives but one sound like any ordinary one, but when pulled up or down a series of howling, penetrating sounds is produced. When placed above the roof of a building, an extension rod should be attached to the piston and a rope or wire to the whistle valve lever. These whistles are manufactured by the Lunkenheimer Brass Manufacturing Company, of Cincinnati, O., U. S. A., under their own patents.

Fig. 1. Fig. 2.

IMPROVED STEAM WHISTLES.

IMPROVED METHOD OF HANDLING NITRO-GLYCERINE.

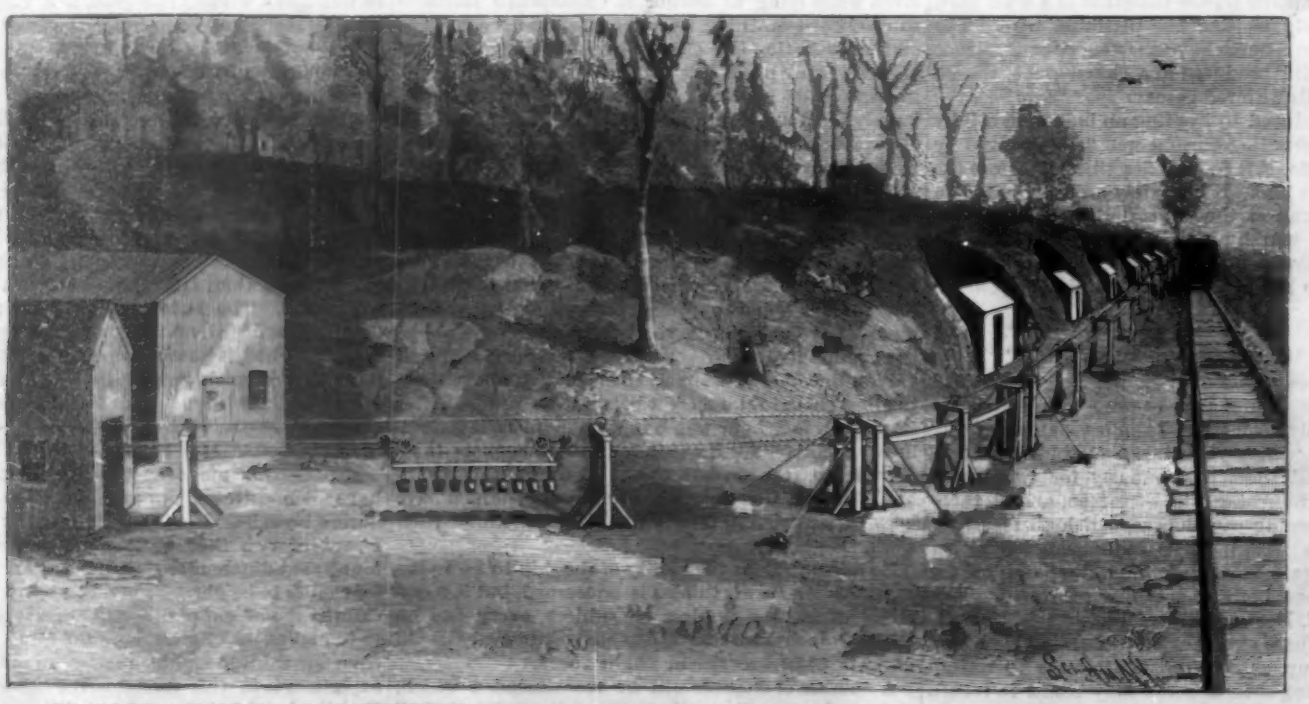
The dangers incident to the handling of nitro-glycerine in the manufacture of various grades of dynamite, giant powders, etc., have led to the introduction of the improved method shown in our illustration, which has been adopted at the Giant Powder Works, Hopatcong, N. J. The nitro-glycerine tank or storehouse, it will be seen, is situated some distance from the mixing houses, five in number. As formerly worked, the liquid was carried by lead piping from the tank house to the several mixing houses, but this method endangered the whole property in case of an explosion taking place at any point, as there was a chance of the piping communicating it to the different places about the works. In erecting a new plant, and in search of a safer method of carrying the nitro-glycerine, this matter was suggested to the Union Wire Rope Tramway Co., 117 Liberty Street, New York, who designed the arrangement shown in the view, the work being specially devised by Mr. S. A. Cooney, an engineer who has several patents on this method of conveyance.

DIXON'S SALT HOLDER AND SPRINKLER.

A double wire rope tramway is supported on framed towers, at sufficient height above the ground to allow a man to conveniently take off and put on the carriage the pails containing nitro-glycerine. The tramway is worked from an engine house close to the tank house, as follows: The engineer, or a man for the purpose, fills the different pails and hangs them on the carriage, which is started on its way to and stops at the first mixing house, the man in charge of which takes off two full pails, replacing them by two empties. On signal, the carriage goes on to the second mixing house, where the same operation is performed, and so on until it reaches the last, when all the empties are carried back to the starting point, and the operation is again gone over.

The tramway consists of two $\frac{5}{8}$ inch steel wire ropes, supported every 50 feet on brackets attached to the frames. The curved portion of the line, about 40 feet long, is made with two wrought iron rails, the ends pointed and clamped with the ropes in special cast iron brackets to make the line continuous and prevent jars, special guide sheaves being placed at intervals around the curve to carry the hauling rope.

The carriage, specially designed for this plant, consists of two carriers connected by a $\frac{3}{4}$ inch rod above and a bar below on which the pails are suspended.



TROLLEY SYSTEM OF CONVEYING NITRO-GLYCERINE—GIANT POWDER WORKS, HOPATCONG, N. J.

Each carrier has two 8-inch rubber-lined sheaves running on alternate ropes, to equalize any jarring and prevent explosions.

The first cost of the tramway, which is about 600 feet long, in comparison with a complete system of lead piping, is very much in favor of the former, which, with its designed immunity from the dangers of explosion, should commend this method to the attention of those engaged in the handling of high explosives.

ERUPTION OF THE VOLCANO OF ETNA.

On Sunday, July 10, an earthquake, followed by an eruption of Mt. Etna, caused considerable damage to the town of Nicolosi, on the south side of the mountain, and eight miles northwest of Catania. The advices show that the stream of molten lava flowing from the volcano increased in width and volume during several days, being near the crater over fifteen yards wide, and at a distance therefrom dividing into two streams. A large area of cultivated land has been laid waste and great destruction has been wrought among the vineyards. The villages of Nicolosi and Belpasso it was thought would doubtless be totally destroyed, and three days after the outbreak over twelve thousand people had left their homes and were encamped in the fields. Vesuvius is now also reported to be unusually active, throwing up lava abundantly.

The aspect of Mount Etna and vicinity since its eruption in 1879 is shown in the accompanying illustrations. Thriving cities, with numerous cupolas, are stretched out at the base of the mountain, and numerous villages, with long-pointed steeples, lie scattered over the lower region. These form a vast panorama, and terminate at a confused assemblage of conical hills, which formerly were so many craters. Above these we see rising, immense and majestic, the cone of the volcano, which overtops the clouds and forms the highest point of the island. The cultivated zone of Etna extends beyond 3,900 ft. elevation. From this limit vegetation rapidly grows poorer, and, toward an elevation of 6,500 feet, becomes very rare. However, up to the base of the central cone, that is to say, at about 10,000 feet, the vegetable kingdom is still represented by four small plants, whose botanical names are as follows: *Robertsia taraxacoides*, *Artemisia ætnensis*, *Senecio ætnensis*, and *Tanacetum vulgare*. The slope of Etna is very slight up to an elevation of 3,200 to 4,000 feet, and in general makes an angle of only 15 to 20 degrees with the horizon; beyond this it rapidly increases, but at 9,500 feet the inclination of the ground is suddenly interrupted by a sort of plain covered with black sand. This is the *Piano del lago*. At 1,300 feet to the north of this plain rises the cone of the central crater, at the foot of which is the astronomical observatory and the *Casa Etnea*, a small hotel designed for travelers who make the ascent of the volcano. The mouth of the crater of Etna is nearly 6,000 feet in circumference, since it was enlarged by about 1,800 feet at the eruption of 1879. The interior of the crater exhibits the aspect of a large cup filled with scoriæ and lava, among which are interspersed numerous fumaroles. At the bottom of the cup, at a depth of 200 feet, there is seen the aperture of the eruptive channel, which usually has a diameter of about 650 feet.

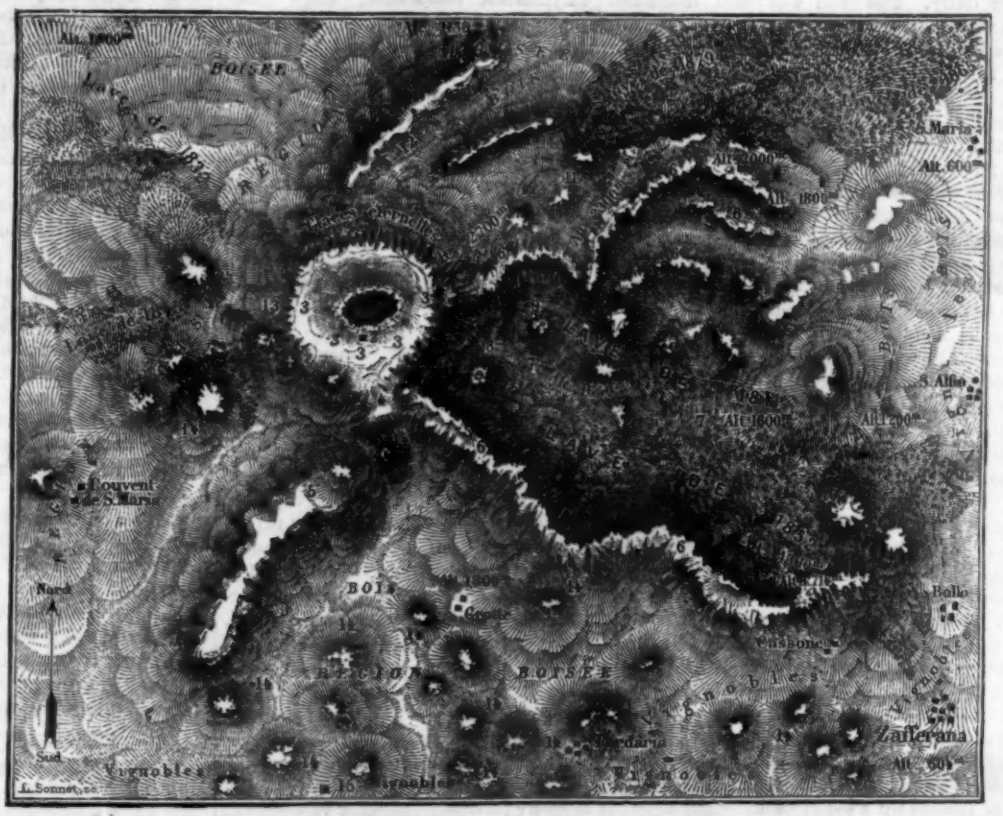
Mount Etna is situated on a tertiary formation, and is almost entirely composed of volcanic materials. On the eastern side of the mountain is a vast depression known under the name of the *Valle del Bove*, about six and a quarter miles long by three miles wide. Its depth at one localities is more than three thousand feet, and its sides are surrounded at the north, south, and west by high rocks, several of which exhibit characteristics of aspect that are truly admirable.

Some of these rocks are formed of a very black lava, which well imitates antique serpentine. Others exhibit a color of a dark red, due to the oxidation of ferruginous matter. Moreover, the alteration of the mass of mineral is so advanced that it exhibits a whitish color similar to that of carbonate of lime, and there are also places where the lava is of a characteristic yellow color, which has caused the rocks wherein it is found to be styled *mountains of gold*.

Along with this, the rocky chains which border the Valle del Bove present a greater interest, in that they are almost all composed of several alternating strata of lava intermingled with banks of earthy materials and traversed in all directions by numerous veins of other and more recent lavas, the origin of which can be easily explained. For it is well known that when one of the sides of the mountain bursts to give passage to the incandescent matter, there results usually around the principal fracture other radiating fractures which decrease in size as they are prolonged to varying distances; and the liquid lava then penetrates these secondary fractures, fills them, and seals them up on solidifying. Thus, by examining the position of these strata and veins, there may be constructed a very extended chronology of the old eruptions.

The eruption of 1879 was considered by Prof. Silvestri, in a report made to the Italian government, to have been in a stage of preparation or partially suppressed development for a period of five years. It broke out May 26, there being craters on the north and south sides of the mountain, the latter having eight eruptive mouths, but the stream on the south side of the mountain did but little damage. From the eruption on the north side, by the evening of May 29, the lava had flowed 6¼ miles, destroying the bridge of Passo Pisciaro and crossing the postal road between Randazzo and Linguaglossa. After the evening of June 1 the force of the eruption began somewhat to abate, and by June 6 it was practically at an end. The lava stream ran nearly seven miles from its source, and ultimately stopped 500 yards from the River Alcantara, and about half a mile from the village of Mojo.

At its termination it is 23 feet in breadth and nearly 33 feet in height. The lava stream entered the bed of the Pisciaro torrent with a velocity of from four to five meters a second, which was reduced to two meters a minute in the lower valley of less inclination. In seventy-six hours the lava had flowed more than six miles from its source.



1. Central crater (16,800 feet altitude). 2. Astronomical observatory. 3. Plain of the Lake. 4. Montagnola (8,660 feet). 5. La Schiena dell'Asino. 6. Rocks bordering the Valle del Bove. 7. Valle del Bove. 8. Eruption craters of 1852. 9. Crater of 1811. 10. Monte di Calanna (4,200 feet). 11. Craters of 1879. 12. Valle del Leone. 13. Other craters of 1879. 14. Ancient craters. 15. Casa del Bosco.

MAP OF THE UPPER REGIONS OF ETNA.

1. Edge of the central crater. 2. Astronomical observatory. 3, 3, 3, 3. Rocks bounding the Valle del Bove. 4. Mount Rossi. 5. Village of Nicolosi.

MOUNT ETNA SEEN FROM THE PORT OF CATANIA (SOUTH SIDE).

A New Process for Enameling Silver Prints.

BY DR. LEO BACKLAND.

This process gives a better finish to the prints and renders these waterproof. Such enameled prints can be easier mounted than by the usual methods, and when being mounted the gloss is not decreased by the application of paste.

Clean glass plates are rubbed in with talcum as for the usual process and then afterward the plates are collodionized with collodion containing 1 per cent gun cotton. When the layer of collodion is perfectly dry, the plate is coated a second time with a solution of rubber in benzole. This solution is easily made by dissolving 1 ounce of unvulcanized Para rubber in 100 ounces of benzole and straining through muslin after complete dissolution of the rubber. When the India rubber coating is dry the so prepared plate is ready for receiving the print. If the print is on albumen paper, it is soaked in a warm ten per cent solution of good gelatin, after which it is applied with its surface on the prepared plate, softly squeegeed upon it and then allowed to dry, and when strictly dry it is stripped off in the usual way.

Prints on aristotype paper can be enameled with much less trouble by squeegeeing them simply when wet on the glass plate coated with collodion and rubber and slipping them off when dry.

A Big Model for the World's Fair.

At the World's Fair at Chicago, next year, will be a complete model of the entire plant of the H. C. Frick Coke Company, of Scottdale, Pa. This company employs many million dollars capital in their business, and is the largest of the kind in the world. The contract for the model has been let to the Jones Bros. Company, of Cincinnati, Ohio, who are experts in the making of models. Its estimated cost is between three and four thousand dollars. The plant will occupy a space about 20×50 feet, made on scale of one twentieth of an inch to the foot, and will be an exact facsimile of the original, including boilers, engines, piping, elevated tracks, cupolas, cars and all other machinery, and will be in operation. The motive power, however, will be electricity.

BRICKS are extensively manufactured in Japan for home consumption, but a small quantity has been exported as a venture to Vancouver, and should the demand there justify further exportations, bricks could be shipped thither as ballast at nominal rates. Mr. Layard mentions that the wages paid at the largest of these factories range from 20 to 25 cents per day for men, and from 10 to 15 cents per day for women.

GREAT MINERAL WATER BATHS.

There are scattered over this country a large number of natural mineral springs whose waters vary, both as to temperature and constituents, to such an extent as to adapt them as curatives to almost every disease human flesh is heir to, and it is a curious fact that we find in the United States springs that correspond in almost every particular to the noted springs in Europe. We also have many artesian wells yielding mineral waters differing widely in chemical composition and varying in temperature from 47° to 184°. Some of these wells were bored with the expectation of finding mineral waters, but the most of them were put down for the purpose of obtaining pure water, petroleum or gas.

At Stockton, Cal., there is an artesian well 1,700 feet deep, from which flow 2,250 gallons of water a minute. In addition to this large flow of water, the well yields 75,000 feet of illuminating gas daily. The well was bored for natural gas, but the water, on account of its pleasant temperature and medicinal properties, was found to have great value for the purposes to which it is applied.

The water issues from the well at a temperature of 86° Fah., and supplies a miniature lake varying in depth from a few inches to 10 feet. This lake, which is about 400 feet long and 80 feet wide, is fitted up as an immense swimming bath and is surrounded by 115 dressing rooms. The water being continually renewed by the flow from the well, the temperature of the lake is maintained between 80° and 86°. Bathers at this place derive great benefit from baths in this water, and draughts of it prove beneficial. Analysis shows it to be impregnated with common salt, soda, magnesia, iron, and sulphur. Fish are often seen jumping from the surface of the lake. Several varieties have been caught there by our own artist, who made the accompanying sketches. It is supposed that the fish find their way into the water of the lake through the overflow.

Our engraving shows the separator by means of which the water flowing from the well is separated from the gas and directed to the lake. The gas is conveyed to a gasometer, from which it is distributed for lighting and heating purposes. A second well is being drilled, but up to the present time the only yield from this well is gas. It is thought that the absence of water is owing to its proximity to the first well. However, the work is being pushed still further, with the expectation of finally striking a good flow of water.

When the out of door temperature is too low to permit of bathing in comfort, bathers resort to the covered baths, the air of which is heated by a jet of natural gas burning freely in the room, as shown in one of the engravings.

It is stated that as many as 1,000 bathers can be accommodated daily at this place. In addition to the large bath and the inclosed baths, there are twelve private bath rooms containing large tubs, and other rooms containing bath tubs for children too small to be taken into the lake.

This place has become a great resort, not only of the citizens of Stockton and the surrounding country, but of people from distant places who visit the place as much for pleasure as for the beneficial effects of the mineral water. These baths are probably the most popular inland resort on the Pacific coast.

Some Strange Plants.

The line between the vegetable and animal kingdoms is very narrowly drawn. Indeed, as all naturalists are aware, there are certain forms of lowly life which it is difficult to assign to either kingdom, presenting as they do features which, taken singly, might cause the one to be identified now with one and now with the other. But even in more highly developed forms there are instances of plants whose carnivorous habits seem to suggest some survival of a former animal instinct, or at least some strange adaptation to circumstances of a nature entirely opposed to those by which the great bulk of plant life is affected.

The *Mediterranean Naturalist*, published at Malta, quotes from the Liverpool *Post* the following description of an adventure that befell a naturalist who has recently returned from Central America. This gentleman, after two years' study of the botany of that region, has brought with him a story which, if it be anything more than a "traveler's tale," may well make us thankful that the woods of our temperate clime contain nothing more inimical to the integrity of the human form than burrs and briars. He tells of a strange plant which he found in one of the swamps surrounding the Nicaragua Lake.

While hunting for specimens he heard his dog cry out, as if in agony, from a distance. Running to the spot whence the animal's cries came, Mr. Dunstan found him enveloped in a perfect network of what seemed to be a fine, rope-like tissue of roots and fibers. The plant or vine seemed composed entirely of bare, interlacing stems, resembling more than anything else the branches of a weeping willow denuded of its foliage, but of a dark, nearly black hue, and covered with a thick, viscid gum that exuded from the pores. Drawing his knife, Mr. Dunstan attempted to cut the poor beast free, but it was with the very greatest difficulty that he managed to sever the fleshy muscular fibers of the plant. When the dog was extricated from the coils of the plant, Mr. Dunstan saw to his horror that its body was bloodstained, while the skin appeared to be actually sucked or puckered in spots, and the animal staggered as if from exhaustion. In cutting the vine the twigs curled like living, sinuous fingers about Mr. Dunstan's hand, and it required no slight force to free the member from their clinging grasp, which left the flesh red and blistered. The tree, it seems, is well known to the natives, who relate many stories of its death-dealing powers. Its appetite is voracious and insatiable, and in five minutes it will suck the nourishment from a large lump of meat, rejecting the carcass as a spider does that of a used-up fly.

Another strange plant that has lately been discovered flourishes in masses, resembling huge gray bowlders from five to ten feet across, covered with lichens and grass, seen in the lowlands of the Falkland Islands, and each one proves to be a single umbelliferous plant, a specimen of balsam bog (*Bolax glebaria*). These have grown so slowly, and have been so compressed in branching, that they are almost as hard as the rocks they resemble. The circlets of the leaves and leaf buds are seen as tiny hexagonal markings, terminating in a multitude of stems, which have been steadily growing for centuries. The plant emits a pleasant odor in the warm sunshine, and the top exudes an astringent gum that is prized by the shepherds.

Lac Insects in the United States.*

Several kinds of plants have recently been discovered in the United States which are infested by lac insects, notably the "stink weed" and a certain variety of acacia. These flourish abundantly from southern Utah to northern Mexico and from the Colorado Desert to western Texas. There is no reason why these valuable insects should not be gathered and put to very profitable use. It is even asserted that, with care and cultivation, the production of them could be rendered so large as to make Americans independent of foreign supplies of lac. Artificial propagation is resorted to abroad, although the bulk of the product is gathered from the jungles. Its employment is most familiar in the lacquered ware manufactured in the East, though it is utilized for many other purposes, notably in the composition of sealing wax and varnishes.

The "lac" of commerce is a resinous incrustation, resulting from punctures of the twigs and branches of certain kinds of trees by insects. Its color varies from deep red to bright orange, and it occurs in brittle fragments. The female insects utilize it for the purpose of protecting their progeny. As soon as each one has covered herself with the secretion, which serves as a sort of cocoon, she lays her eggs and dies. The young, upon being hatched, make their way out through the crust, and seek green and juicy spots on the bark, inserting their probosces and beginning to feed at once. They never wander from the branch where they first came into being. The latter, after affording nourishment to millions, finally withers and dies. Thus the extinction of the lac-making species would soon come about were it not for the fact that other insects and birds carry them about, planting new colonies in fresh places.

The lac insects are most plentiful in India, but they are also found in Siam, Ceylon, and other countries. Siamese lac is considered the best. Certain provinces of India yield thousands of tons of "stick lac" annually. The right of collecting the lac in some parts is rented out by the government to companies, but the gatherers of lac are mostly jungle tribes. They obtain the product in the wild forests, sell it to small dealers, who in their turn dispose of it to big merchants. Much is done in the way of propagating the insects artificially in the central provinces of India. For this purpose, nurseries of the proper kinds of trees, such as the insects naturally feed upon, are formed. At the right season, when the larvæ are about to be hatched, twigs bearing the incrustations are cut in the woods and tied with bits of grass to the upper branches of the trees in the nursery. The insects are thus transplanted to nursery trees, where they rapidly multiply and form the precious lac. At regular intervals the twigs bearing the lac are cut off—this process of pruning encouraging the development of fresh twigs for insects to feed upon.

The crude lac on trees is called "stick lac." In manufacturing it the first process is to strip the twigs of the incrustation by passing them under rollers. The wood is rejected and the separated lac is ground up by rolling into a coarse powder. In this form it is put into large tubs half full of water, in which it is stamped and trodden by coolies, who get into the tubs and do the work with their feet. The water is changed repeatedly, this performance being kept up until it comes off entirely clear. Then the lac is dried, being now designated as "seed lac," after which it is put into long cotton bags. Two men take one of these bags containing lac by the ends and hold it in front of a charcoal furnace, twisting it the while. The roasting melts the lac and the twisting causes it to exude through the cloth and drop into a trough below. From the trough it is dipped out with a wooden spoon and skillfully spread over a metal cylinder in such a manner that, cooling and hardening immediately, it is formed into thin sheets. These sheets are the shellac of commerce.

* From the Washington *Star*. Reprinted from the *Oil, Paint and Drug Reporter*, May 25.

Forbidden by Law to Use Sea Water.

One of the curious ways the French government has for obtaining its revenue is told by Edmund Yates in the New York *Tribune*.

In confirmation of Mr. Yates' story, one of the editors of this paper had like experience on the shore of the Mediterranean some years ago.

The doctor who was in attendance on a member of the writer's family desired his patient to have sea water baths daily at the hotel. But before the attendant dare to dip even a pail of water from the sea a permit from the prefect of the police had to be obtained, and to get his permission it required the physician's certificate.

A well known English public man, writes Mr. Yates, member of a former administration, staying in one of the many quiet and pretty villages on the Riviera, the garden of his temporary home running down to the sea, on a recent morning, so the story runs, wished to vary his usual bedroom bath by substituting salt water for fresh, and asked that a pailful be fetched for him. To his intense amazement he was informed that this could not be done without special permission from the civil power. There was the Mediterranean stretching broadly before his bedroom window, countless miles from east to west, and away again toward Corsica in the south as far as the eye could reach, and at the end of the garden, mind you, and yet as much of it as would fill an ordinary pail must not be taken from it. It was too absurd for belief. It turned out to be quite true, however. Not a servant nor a villager could be induced to draw a few quarts out of the sea for fear of the penalties which would follow, and in the end the official permission of the mayor of the village had to be formally sought and granted before the English politician could have a salt water sitz bath. The tax on salt was at the root of this anomaly, and the stringent restriction was to prevent the natives from boiling down sea water and making salt for themselves.

Patent Rights Cannot be Taxed.

Judge McPherson, of the Pennsylvania Supreme Court, has handed down an opinion holding that the Westinghouse Electric and Manufacturing Company, notwithstanding the varied powers conferred by its charter, is nevertheless exclusively for manufacturing purposes. He discusses at great length the patent right feature, which he says "presents a question of great importance which has not been decided by any court of last resort, so far as we are aware, and which deserves and has received our consideration." He sustains the contention of the company's counsel, and holds that the right to tax patent rights does not exist in the State, because "as a tax upon the right itself we think it cannot possibly be supported, because it restricts and interferes with a right granted by Congress in the exercise of power exclusively committed to the government of the United States by the federal constitution. The tax is not only derogatory from the dignity but subversive of the powers of the government and repugnant to its paramount sovereignty."

The court expressly states, however, that the opinion is restricted to the intangible right existing in the patents, and does not extend to tangible articles manufactured under patent rights. The judgment in each case is wholly in favor of the company. The amount involved in the Westinghouse case was $8,839.90 for 1888; $14,694.46 for 1889; and $16,739.57 for 1890.

Counting Coins by Electricity.

In the London Mint, it is stated in the master's report just published, a new counting machine for telling bronze coin has been erected in the bronze store. It was designed by Messrs. Maudslay, Sons & Field, Limited. The machine has four distinct sets of counting apparatus, each of which can be worked independently of the others, and when all four are in full work upward of 3,000 pence can be counted per minute. The coin to be told is raised to the level of two tables placed on a platform by a lift worked by an electric motor, which also drives the counting machines. A pair of these machines is fed from each of the two tables, the coins passing from the table down an inclined iron plate forming a flat hopper, from which they issue in single file through a channel of appropriate width. They are then gripped by a pair of India rubber driving wheels, which force the coins past the rim of a thin disk provided with recesses in its circumference to fit the circular edges of the coins. As the disk is thus made to revolve, the coins are pushed forward, falling into a bag placed to receive them, and continue to advance until the counting wheel is automatically stopped and the bag containing the coins is removed.

CYRUS W. FIELD.

The successful laying of the Atlantic cable marked a great step in modern progress, and with that event is indissolubly linked the name of Cyrus W. Field, who died at his summer home, Ardsley, near Dobbs Ferry, N. Y., on July 12, in his seventy-third year. He had been lying in a critical condition for ten days, subject to violent delirious spells, each one of which threatened to end his life, and through which he was carried only by a wonderful vitality. At the time of his death there were present his three brothers, David Dudley Field, Rev. Henry M. Field, Justice Stephen J. Field, of the United States Supreme Court.

Cyrus West Field was born in Stockbridge, Mass., Nov. 30, 1819, his father, David Dudley Field, being a Congregational clergyman. Cyrus Field's elder brothers, David Dudley and Stephen Johnson, were sent to Williams College, but the father was unable to do the same for him. When he was 15 years old he came to New York, where his brother, David Dudley, already in practice as a lawyer, got for him a clerkship in A. T. Stewart's dry goods store, where he worked three years, beginning at $1 per week, being advanced to $2 per week the second year and $4 the third year. At the end of his term of apprenticeship he went into business for himself as a junk dealer and paper maker.

In spite of one failure he made enough in twelve years to be able to retire from business. He was 33 years old when he did this. When he was 21 he had married Miss Mary Bryan Stone, of Guilford, Conn., who died only a few days ago, and by whom he had six children.

In 1853, a few months after he had retired from business for life, as he had supposed, he became interested in the subject of submarine telegraphy. It was brought to his attention by a telegraph operator named Gisborne, who had secured a charter from the Newfoundland Legislature for a cable between St. Johns and New York. A cable was laid across the Gulf of St. Lawrence after great difficulties. Mr. Field then induced Peter Cooper, Moses Taylor, Marshall O. Roberts, and Chandler White to join him in the enterprise. A company was formed under the title of the New York, Newfoundland and London Telegraph Company. It was thirteen years after this before any results worth speaking of were obtained. This was the most remarkable period of his life. He bore up against rebuffs of all kinds and financial disaster which would have easily subdued most men. He made fifty journeys across the Atlantic on behalf of his scheme. A few great men encouraged him. Mr. Thackeray and John Bright were among them. In this country he found the reluctance of the investing public even greater than in England. After a long series of dismal failures a cable was laid in 1858. Two ships, one coming from Newfoundland and the other from Ireland, met and spliced the ends together. Messages were sent over the cable for a few weeks, and then it became useless.

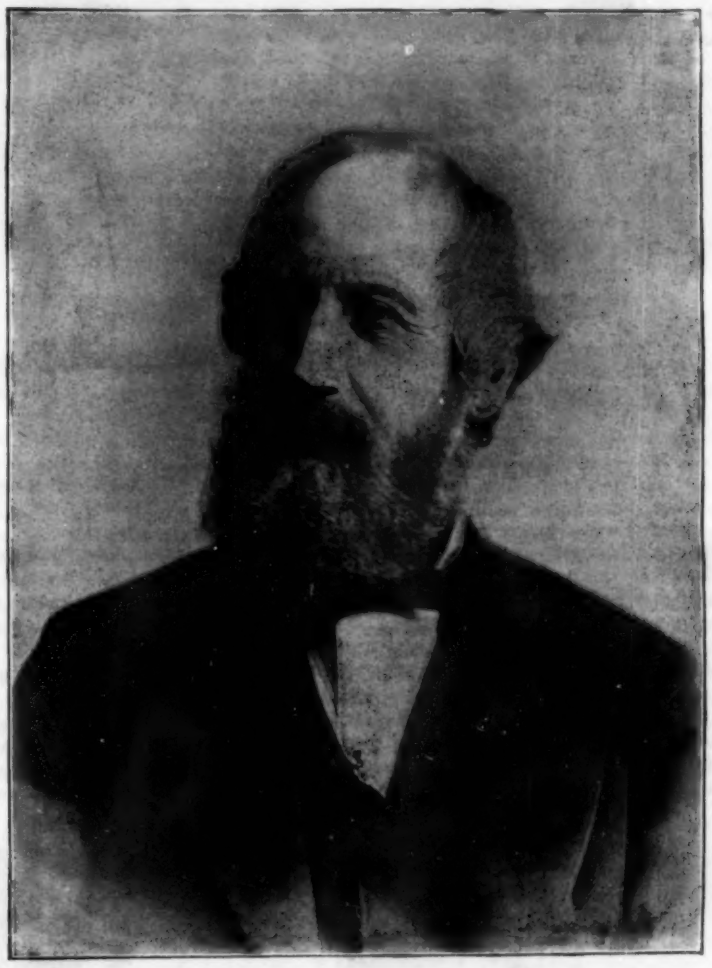
Undaunted by this failure, Mr. Field again went to England in 1859 to make preparations for another attempt to lay the cable. Mr. Field's company had a nominal capital of $1,750,000, representing 350 shares of $5,000 each. Mr. Field himself subscribed $440,000. Great Britain granted an annual subsidy of $70,000 and the United States an annual subsidy of $70,000 for twenty-five years. Both governments granted the use of ships of war in laying the cable.

In 1865 the Great Eastern started to lay the cable. When the cable had been laid 1,200 miles from Valentia, and only 600 more remained between it and Heart's Content, it was broken by a sudden lurch of the vessel and sank two miles and a half into the ocean. Repeated attempts to bring the ends of the cable to the surface failed. The enterprise was abandoned for that year, but in the summer of 1866 it was resumed. All honor was given Mr. Field after that notable July 27, 1866, when the feat was finished. Congress voted him a gold medal and the thanks of the country. John Bright, in Parliament, called him "the Columbus of modern times." The Paris Exposition in 1867 gave him the Grand Medal. Other marks of appreciation were the thanks of New York, with the freedom of the city and a gold snuff box; the thanks of the Chamber of Commerce of New York, with a gold medal; the thanks of the State of Wisconsin, with a gold medal; the thanks of the American Chamber of Commerce of Liverpool, with a gold medal; a decoration from King Victor Emanuel, of Italy; and a silver service from George Peabody.

Mr. Field himself, after the success of the cable, thus touchingly told of his personal experiences: "It has been a long, hard struggle—nearly thirteen years of anxious watching and ceaseless toil. Often my heart has been ready to sink. Many times, when wandering in the forests of Newfoundland, in the pelting rain, or on the decks of ships, on dark nights—alone and far from home—I have almost accused myself of madness and folly to sacrifice the peace of my family and all the hopes of life for what might prove after all but a dream. I have seen my companions, one and another, falling by my side, and feared that I, too, might not live to see the end. And yet one hope has led me on, and I have prayed that I might not taste of death till this work was accomplished. That prayer is answered, and now, beyond all acknowledgments to men, is the feeling of gratitude to Almighty God."

Ten years later, in 1876, when Mr. Field was in possession of an ample fortune, and had achieved a position with which most men would have been content, he became interested in the plan of supplying New York City with rapid transit by means of the elevated railroad system. Dr. Gilbert had been for some time previously pushing this scheme, and to his efforts were due the construction of the first portion of the present system, in Ninth Avenue. But it was not till Mr. Field took hold of the enterprise that anybody realized that this method of rapid transit would ever amount to anything. He interested Samuel J. Tilden and other capitalists in the undertaking, and the building of the present main lines of elevated railway from the Battery to the Harlem River rapidly followed. This method of transportation has proved a great boon to New York City, and the stock which Mr. Field originally bought for $14 a share went up to $173 a share. Mr. Field afterward lost a considerable part of his fortune by the manipulation of prominent Wall Street operators in the elevated railway stocks, and the stratagems employed in the management of the property and combinations of different interests. He finally retired from business in the summer of 1887, although he still remained a special partner in the banking and brokerage business of his son, Edward M. Field. The disastrous failure of this house last year, and the subsequent confinement of the son in an insane asylum, where he was at the time of his father's death, undoubtedly had much to do with hastening the death of the father.

The lives of but few men afford illustrations of such wide extremes of fortune as Cyrus W. Field passed through. From a most humble beginning his course was a constant battle, persistently and pluckily fought, with far more than the ordinary number of reverses, till he had attained the highest honors and the greatest worldly success. He was most happily married, and for half a century had an almost ideally perfect home, but the last days of his life were inexpressibly saddened by the affliction which came to him through his son's business downfall and mental aberration. He had earned and enjoyed the highest distinctions, and had experienced the severest reverses and the most cruel blows of misfortune, but he never lost his self-poise, and to the very last his spirit was brave and resolute.



CYRUS WEST FIELD.

End of a Long-Contested Patent Office Case.

The Commissioner of Patents has decided a long-standing controversy between Thomas A. Edison and Joseph W. Swan, in favor of the latter. The matter in contention was as to the priority of right to a patent for an electric light carbon for incandescent lamps. The dispute had been pending since 1881.

Swan laid claim to having invented the parchmentized paper in March, 1880. He filed his application in April following, and the patent was issued in October following. Edison did not file his application until May, 1881, but he said that he had made and used the invention as early as 1879. Edison asserted his claim under the provision of law which entitles the inventor to his product as soon as he discovers it, and not from the date of his application for a patent. In 1881 Edison filed the following issues of interference:

"1. A carbon formed from a straight strip of cardboard paper or parchment paper, and bent to the form of an arch, hoop, or loop, and carbonized by heat while in a bent condition.

"2. A carbon for an electric lamp made of the carbonized parchment paper."

On these testimony was taken on both sides, and for a time a spirited legal battle was waged. The Westinghouse people took an active hand, for at that time they thought that the parchmentized paper would continue to be of invaluable profit to them. But electrical genius was too fertile to stop short at parchmentized paper as the best material for incandescent lamps, and in a year or two there were a half dozen new patents that were considered superior to it. Since that time the case has lagged, not being considered of any material commercial value.

The Diameter of Fulgurites.

When a bolt of lightning strikes a bed of sand, says an exchange, it plunges downward into the sand for a distance, less or greater, transforming simultaneously into glass the silica in the material through which it passes. Thus, by its great heat, it forms at once a glass tube of precisely its own size. Now and then such a tube is found and dug up. Fulgurites have been followed into the sand by excavations for nearly thirty feet. They vary in interior diameter from the size of a quill to three inches or more, according to the bore of the flash. But fulgurites are not alone produced in sand; they are found also in solid rocks, though very naturally of slight depth and frequently existing merely as a thin glassy coating on the surface. Such fulgurites occur in astonishing abundance on the summit of Little Ararat, in Armenia. The rock is soft, and so porous that blocks a foot long can be obtained, perforated in all directions by little tubes filled with bottle-green glass formed from the fused rock.

The Electric-Lighted Buoy Service in the Harbor of New York.

In a recent article which appeared in these columns we commented on the Gedney's Channel buoy installation. The advantages of electrically lighted buoys are obvious. It is safe now for large steamers to enter the harbor at night, picking their way along the channel by the lighted channel buoys, and steamers frequently do so. Our allusion to the difficulties of maintaining the system referred to the troubles incident to all submarine cable work, especially where current has to be conveyed to floating objects and where absolute certainty of operation is a *sine qua non*. The system is an advanced one, and has our best wishes for its success.

INEXPENSIVE ELECTRIC MOTORS.

We are pleased to notice that there is one concern in this country having sufficient enterprise, and confidence in an appreciative public, to construct a line of small electric motors which are electrically correct, mechanically perfect, and well worth the price asked for them. One style sells for $1, another for $1.50. Both are complete with battery and chemicals for charging the same.

Fig. 1 shows the dollar motor, the battery being inclosed in the base; Fig. 2 shows the dollar and fifty cents motor, which is provided with two cells of battery in the base. Both of these motors are furnished with Siemens H-armatures, with adjustable commutator brushes, and with field magnets regularly wound and connected up in series with the armature.

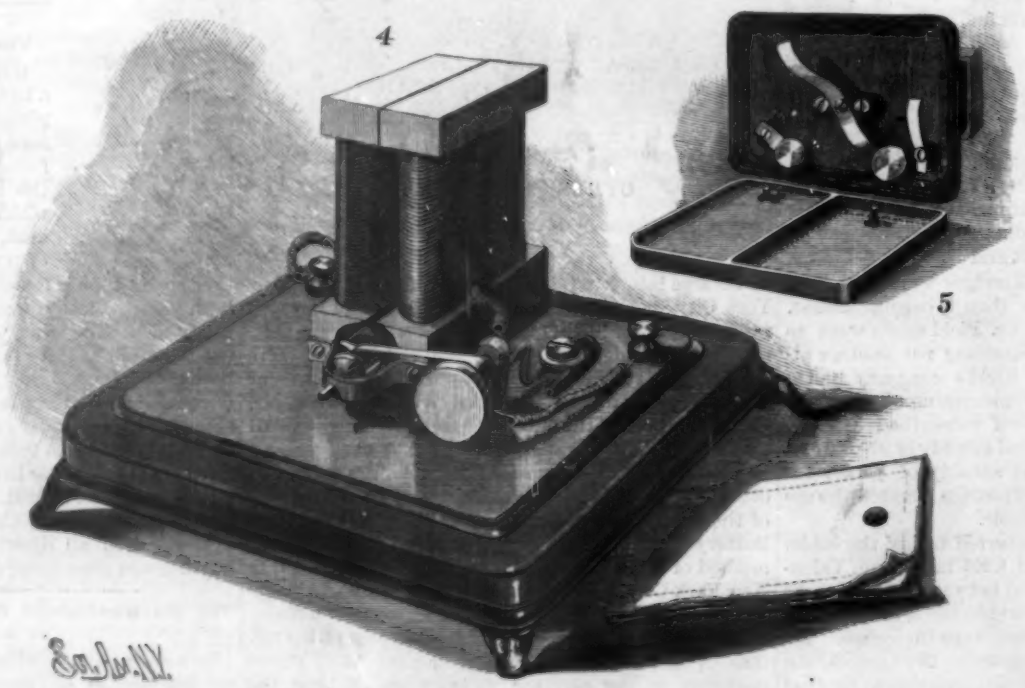
In the motor shown in Fig. 1, the field magnet consists of a pair of polar projections formed integrally with the magnet core and a single bobbin formed of 27 feet No. 18 wire, A. M. W. G., wound on the core. The armature is 1½ inches in diameter, and the end pieces or polar extremities are ⅝ of an inch wide and ⅜ inch long. The portions on opposite sides of the armature shaft which receive the armature winding are ½ inch in diameter and ⅞ inch long. The winding of the armature consists of 15 feet of No. 22 wire, which is wound on the core after the manner of a straight electro-magnet, and the extremities of the wire are connected with a two-part commutator mounted on the armature shaft. The commutator is formed of a cylindrical wooden core with two semicircular pieces of copper attached to opposite sides thereof by clips projecting from the edges of the copper pieces and bent into the concaved ends of the wooden core. The commutator brushes consist of two copper springs looped at their outer ends and pivoted on wires running through the spool, the springs being pressed toward each other and into contact with the commutator cylinder by a rubber band surrounding both of the springs.

ONE DOLLAR ELECTRIC MOTOR.

The battery in the base of the motor consists of a copper pan provided with a central rivet extending upwardly and surrounded by a piece of rubber tubing, a piece of thick loose felt and a zinc disk resting upon the felt, but out of contact with the pan and central rivet. To the bottom of the wooden base which forms the cover of the battery are attached two copper springs, one of which rests upon the zinc plate and the other upon the end of the rivet, thus establishing an electric connection between the two poles of the battery. One of these springs is connected with one terminal of the field magnet, the other terminal of which is connected with one of the pivotal wires of the commutator spring; the other pivotal wire is connected with the other spring. The battery is charged by placing under the felt some powdered sulphate of copper and upon the top of the felt a little sulphate of zinc, then filling the cell up with water so as to immerse the zinc. The battery thus charged is sufficient to run the motor for two or three hours. The motor, however, is capable of withstanding the current of a much larger battery, and if connected with such a battery it might do a considerable amount of useful work.

The motor shown in Figs. 4, 5 and 6 has a field magnet with double arms which are oblong in cross section and are wound in the regular way. The armature is of the Siemens H pattern, of small diameter but of considerable length. The commutator is like that already described. The field magnet is wound with 64 feet of No. 25 magnet wire, 32 feet being wound on each arm of the magnet. The armature winding consists of 39 feet of No. 31 magnet wire, forming 100 convolutions. The central part or core of the armature is ⅞ inch wide, 1½ inch long and ⅝ inch thick. The battery is a double one, and the under surface of the base of the motor (which is of insulating material) carries a spring which connects a copper plate at the bottom of one of the cells with a zinc plate at the top of the other cell, and other springs are provided for establishing connection between the copper and zinc plates with the binding posts on the motor base, the latter being connected with the armature and field magnet as in the other case. The double cells in which the electrodes are placed is made of insulating acid-proof material, and the copper plate which lies at the bottom of each cell is furnished with an insulated rivet extending upward through a hole in the zinc plate.

The exciting material is carried in a blotting paper pad, shown in Fig. 6, one such pad being placed in each cell between the copper and zinc plates. The pad consists of three thicknesses of blotting paper fastened together by a row of stitching near the outer edge. The space between the middle and lower pieces of blotting paper is filled with pulverized copper sulphate, the space between the middle and the upper pieces of blotting paper is filled with zinc sulphate.



INEXPENSIVE SIEMENS ELECTRIC MOTOR.

All that is necessary to start the battery is to place these pads in the cells and pour in sufficient water to saturate them and effect a partial solution of the salts contained in the pad. A dozen or so of such pads accompany each motor and an extra supply can be purchased for a small price.

These little machines are safe and convenient, they illustrate many electrical principles and will serve a useful purpose in every family where young people and those that are older are to be instructed and amused. These motors could be used to considerable advantage in every school, however small or obscure, and certainly the price would be no bar to the establishment of an electrical plant in any school without regard to the condition of the treasury. These little motors are made by the Electro Novelty Company, of Boston.

Isatine.

Isatine, called also *artificial indigo*, is a dark blue violet liquid; it is destined, on account of its low price and the ease with which it is used, to play a very important part in dyeing vegetable fibers.

Isatine can replace advantageously those colors which have been used to top natural indigo upon piece goods and yarns, and will give more or less heavy shades as desired. The shades thus obtained resist the action of the light, also alkalies and acids, and are remarkable for the ease with which they can be fixed upon vegetable fibers. The color can be diluted with more or less hot water, according to the depth of shade required. The liquid can be applied without mordant; it is, however, preferable to add a little alum or other alumina salt, in order that the shade may be faster and more regular.

For topping vat blues upon pieces or yarn the dye stuff may be used to great advantage. In its use the material is first dyed in a vat, is next treated with a mordant of alum or acetate of alumina and nitrate of iron, and finally dyed in a more or less concentrated color bath, varying also the temperature according to the shade desired. The color fixes better upon the fiber if the yarn or pieces bottomed with indigo are treated directly with a mordant of alum and nitrate of iron instead of souring with an acid. The strength of the mordant should be regulated according to the depth of the vat blue. In fact, the lime should be neutralized by the mordant; if the latter is too strong, the color is fixed too slowly, and there is a loss of coloring matter, but if too weak, the color goes on too rapidly and unevenly. To avoid these two difficulties it is very important to observe exact proportions, especially for light shades. For dyeing cotton and linen yarns, after boiling them out, they should be put in a lukewarm and weak color bath for light shades, or hot and strong bath for dark shades, and to the bath should be added alum or acetate of alumina in the proportion of 1 pound of alum for 300 pounds of yarn; finally rinse with water.

The nitrate and the pyrolignite of iron are the proper mordants for dark shades; these shades can be blued with soda, potash, soap, etc. Sumach can be placed advantageously on the bottom. Verdigris added to the color bath gives a more intense blue, which darkens at the end of the dyeing by contact with the air. An addition of aniline violet or fuchsine gives beautiful shades of dark violet, which are fast. A large use for the color is for dyeing fast blacks. Logwood and quercitron can then be used in connection with the color.—*Industrie Textile; Textile Record.*

Treatment of Erysipelas.

Schneider (*Centralblatt für Chirurgie*, No. 1518, 1892) states that he has employed Sachs' treatment for erysipelas with almost invariable success. This consists in applying beyond the involved areas a ten per cent ichthyol collodion mixture. If the extremity is involved, this collodion is spread around the limb above the limit of the disease, forming a band about twice the breadth of the hand. It should be put on in a layer so thick that after drying it presents an appearance as though the limb were encircled with a broad bandage. In nearly all cases, when the inflammation reached the border of this collodion layer, it ceases to spread.

Improvement follows in two or three days, the temperature drops, and symptoms rapidly subside.

Schneider believes that collodion without ichthyol is as efficacious as the mixture suggested by Sachs.

A VISIT TO CHALCEDONY PARK, ARIZONA.

BY H. C. HOVEY.

Twenty years ago a miner who had been prospecting in Arizona gave me an oblong block of peculiarly marked agate. After letting friends cut off a dozen pairs of sleeve buttons from it, I had the rest of the block polished as a cabinet specimen. It was evidently a kind of petrified wood, and the donor told me that there were immense quantities of it in the region where he had been exploring. That same region is now known as the Chalcedony Park, and was mentioned to me by the railroad officials as being one of the most extraordinary of the many remarkable localities along the Santa Fe route. Holbrook was the place where I was told to leave the cars and take a stage for the park. But there was no stage, and the sand storm that was raging at the time was such as no man who valued his comfort and safety was willing to encounter. Corrizo was somewhat nearer the park, but it was a mere watering station, with no houses nor conveyances. On stating the case to the conductor of the fast California express, he kindly relaxed his rules and stopped his solid train of Pullman cars at "whistling post 283" in the midst of the sage brush, and just at sunset. Pointing to a windmill near the horizon, he said, "That is Adam Hanna's ranch, the only house within ten miles. May be you can get a horse there; and if not, you can foot it in the morning." The train rolled on and left me and my kodak alone in the wilderness.

PETRIFIED LOGS—CHALCEDONY PARK, ARIZONA.

After proceeding for about a mile the banks of an arroya were reached, usually dry as a tinder box, but now flooded by melting snow. The stream seemed to be a moving quicksand, and varied in width from forty to two hundred feet. The ranch was on the other side of the stream; but my halloo brought out the inmates, who directed me to a pile of drift wood, as the only means of crossing. Why Mr. Hanna does not occupy higher ground, near the railroad, and further his own interests, as well as those of tourists, by making regular trips to the park, was a matter not fully made clear.

The next morning, after an exciting episode, being nothing less than an attack on the lady of the ranch by a pair of savage coyotes, I started alone, on horseback, for my destination. It was an easy trail, and the distance did not exceed seven miles. But it was a dreary ride over mesas and arroyas, with occasional glimpses of distant mountains. From the very start the road was lined by specimens of agatized wood equal to the one I had been guarding for so many years. Now and then a petrified log, or solitary stump, were harbingers of what was to be seen further on. The term "park" is a misnomer; for there is no natural park here, nor has the hand of man done anything but to shatter the marvelous relics of dateless antiquity. The people of the vicinity always speak of it as "the Petrified Forest." But that again is misleading; for there is no forest, whatever there may have been fifty centuries ago. It certainly seems as if the place ought to be made a national park, and should be both better protected and more easy of access. As it is, the enchanted spot lies at the mercy of vandals, the only precaution against spoliation being a railroad rule against shipping specimens from it in bulk.

How shall the Chalcedony Park be described? At first one gets the impression that it is a small affair, of perhaps fifty acres. Then he says that it must be a hundred. And after riding over its amazing ruins for many hours in succession, he concludes that the area includes a thousand acres; and finally he hardly questions the bold estimate of Mr. C. F. Lummis that the extensive forest now hardened into stone formerly covered "hundreds of square miles;" and accepts without dissent the assertion of Mr. G. F. Kunz, that there may here be seen at a glance a million tons of precious stones. A matter-of-fact visitor might say that the scene reminded him of a vast logging camp, where the lumbermen had tossed the huge logs from their sleds at random, and then had gone away, leaving them to become rain-soaked and moss-grown. The trees when standing were fully two hundred feet high; for even now their prostrate trunks measure, when unbroken, from one hundred to one hundred and fifty feet. The peculiarity already hinted at is that these mighty trunks are as regularly severed into sections as if the work had been done by a cross-cut saw. The lengths vary from disks like cart wheels to logs twenty or thirty feet long, or longer. Twigs are found an inch through, and trunks ten feet thick. They lie at every angle; parallel to each other, and at right angles; singly and in great groups; down in gulleys and perched like cannon on hill tops.

And all these myriads of trunks, stumps, logs, branches and tiny twigs are solid stone. And on inspection they prove to be precious gems of almost every known variety. Those that remain intact have been weathered to a dark red, rich brown, or sober black. But Time's relentless ax, aided by the geologist's hammer, has made havoc with so many of them that the ground is thickly strewn with their fragments, from rocks like bowlders down to chips and minute splinters, that show their brilliant colors under the fierce Arizona sun with kaleidoscopic effect. At every footfall you tread on gems, some of which might grace a ducal coronet, while the most plain and least attractive would be worthy of an honored place in the finest cabinet. There are no rubies, sapphires nor diamonds here (as has been incorrectly reported), but the amethyst abounds, and the red and yellow jasper, chalcedony of every hue, the topaz, the onyx, the carnelian, and every imaginable variety of agate. No log, nor fragment, is limited to a single kind of gem. Many are massive mosaics of all the kinds named above. The material breaks pretty easily into cubical forms, but it is extremely hard, and takes a brilliant and durable polish.

Under a magnifying glass the cellular structure is plainly visible, and experts assure us that the ancient forest was made up of trees analogous to our pines and cedars. The region is decidedly volcanic, lava beds and extinct craters being in sight in every direction. Some catastrophe doubtless felled the "forest primeval," which was subsequently buried in volcanic ashes. Floods of hot silicious waters were poured over the ashes, possibly from geysers. The wood became water-soaked, and gradually the silica took its place and shape. The pure silica, as Mr. Kunz suggests, would form the limpid quartz, while the rich colors of red, brown, yellow, and purple would be due to iron and manganese held in solution. I found one block of wood that had changed to solid iron.

Spurring my horse from the valley to the summit of the mesa, mainly formed of light gray sandstone, I followed a trail to its further side, where it is cut by a small canyon about fifty feet deep. And here is the Agate Bridge, the most wonderful object of its kind in existence. This unique bridge is simply a huge trunk spanning the canyon where it is sixty feet wide. The trunk itself is a hundred feet long, and tapers down from a thickness of five feet to a diameter of three feet. Its entire mass is made up of agates, jaspers, and other precious materials. At a point two-thirds of the way across it is fractured, whether naturally or by violence I could not determine. At the bottom of the canyon is a pool resorted to by the cattle of the plains, and around it grow the only living trees to be seen for miles.

The task of selecting specimens from a million tons of gems is less easy than it is agreeable. Each crystal, or moss agate, or amethyst, or onyx, seems most desirable till it lies in your pocket or saddle pouch, and then others assert their superiority. At last my load was as heavy as could be managed on horseback. With reluctance I left the enchanted forest, made my way back to Hanna's ranch, crossed the perilous arroya, flagged an approaching train, gained permission to take my sackful of treasures on board, and sped on my journey, convinced that whatever marvels may have existed in the days of the Arabian Nights' entertainments, none in these more modern times could rival, in its way, the petrified forest of Arizona.

THE AGATE BRIDGE—CHALCEDONY PARK, ARIZONA.

Attempts have been made, to a limited degree, to introduce agatized wood for ornamentation. The material, however, is so extremely hard as to require special machinery for cutting and polishing, and we do not know of any company that has undertaken this work on a large scale except the Drake Company, of Sioux Falls, Dak., specimens of whose work are on exhibition at Tiffany's, in New York City. The largest of these is a block 36 inches in height, 41 × 34 inches diameter, and weighing 2·1 tons. Its entire top is beautifully polished, showing the many kinds of gems of which it is composed. The Indian name for agatized wood is "Chinarump." For centuries the aborigines have resorted to the Petrified Forest for materials from which to make the precious arrow tips so greatly admired by collectors.

THE dynamo is replacing the battery to such an extent in telegraphy that its use will, it is thought, be universal in a few years. It is both cheaper and more efficient.

The Great Suspension Bridge between New York and Brooklyn.

We are indebted to Charles C. Martin, chief engineer and superintendent of the great bridge, for the following:

DETAILS OF CONSTRUCTION.

Construction commenced January 3, 1870.
Size of Brooklyn caisson, 168 × 102 feet.
Size of New York caisson, 172 × 102 feet.
Timber and iron in caisson, 5,253 cubic yards.
Concrete in well holes, chambers, etc., 5,669 cubic feet.
Weight of New York caisson, about 7,000 tons.
Weight of concrete filling, 8,000 tons.
Depth of tower foundation below high water, Brooklyn, 45 feet.
Depth of tower foundation below high water, New York, 78 feet.
Size at high water line—of New York tower, 140 × 59 feet; of Brooklyn tower, 140 × 56 feet.
Size at roof course—of New York tower, 136 × 53 feet; Brooklyn tower, 136 × 50 feet.
Total height of towers above high water, 272 feet.
Brooklyn tower contains 38,214 cubic yards of masonry.
New York tower contains 46,945 cubic yards of masonry.
Size of anchorages at base, 129 × 119 feet.
Size of anchorages at top, 117 × 104 feet.
Height of anchorages, 89 feet front, 85 feet rear.
Weight of each anchor plate, 23 tons.
Length of river span, 1,595 feet 6 inches.
" each land span, 930 feet.
" Brooklyn approach, 971 feet.
" New York approach, 1,562 feet 6 inches.
Total length of bridge, between Park Row and Sands Street curbs, 6,016 feet.
Total length of structure between Center and Concord Street curbs, 6,952 feet 6 inches.
Width of bridge, 85 feet.
Height of roadway at towers, above high water, 119 feet 3 inches.
Height of towers above roadway, 152 feet 9 inches.
Clear height of bridge in center of river span, above high water, at 90° F. temperature, 135 feet.
Grade of roadway, 3¼ feet in 100 feet.
Maximum grade of railway, 8¾ feet in 100 feet.
Number of supporting cables, 4.
First wire was run out May 29, 1877.
Cable making began June 11, 1877.
Diameter of each cable, 15¾ inches.
Length of single wires in cables, 3,579 feet.
Total length of wire in 4 cables, 14,361 miles.
Each cable contains 5,296 parallel, galvanized steel, oil-coated wires, closely wrapped to a solid cylinder.
Weight of wire, nearly 1 pound to 11 feet in length.
Weight of 4 cables, inclusive of wrapping wire, 3,588½ tons.
Ultimate strength of each cable, 12,200 tons.
Bridge opened for pedestrians and vehicles May 24, 1883.
Railway opened to passengers September 24, 1883.
Cost of bridge at completion, exclusive of land, $9,000,000.
Total cost to April 1, 1884, $15,552,878.

DETAILS OF OPERATION.

From opening of railway, September 24, 1883, to January 1, 1892:
One cable-hauling engine, 30 in. diameter, 48 in. stroke. Speed, 70 revolutions per minute.
One cable-hauling engine, 26 in. diameter, 48 in. stroke. Speed, 70 revolutions per minute.
One cable-hauling engine, 22 in. diameter, 36 in. stroke. Speed, 80 revolutions per minute.
Greatest indicated H. P. observed, 1,093·15.
Least indicated H. P. observed, 65·6 negative.
Speed of hauling cable, 10½ miles per hour.
Hauling cable, 1⅛ inches diameter, 12,000 feet long.
" No. 1, used 1,140 days, hauled 22,142,706 ton miles.
" No. 2, used 607 days, hauled 25,492,892 ton miles.
" No. 3, used 393 days, hauled 20,395,073 ton miles.
" No. 4, used 356 days, hauled 18,923,469 ton miles.
" Nos. 5 and 6 are still in use.
Weight of cars—12 cars, 8 tons each, used to March 5, 1887.
" " 12 cars, 10 tons each, used to October 29, 1890.
" " 48 cars, 17 tons each, in use.
" " 12 " 19 " "
Number of cars in service, 60.
Number of cars in use during rush hours, 48.
Largest number of round car trips per day—April 30, 1889—2,159.
Next largest number of round car trips per day—December 31, 1891—2,014.

Total number of round car trips made by cable	3,477,000	7,388,625 miles.
Total number of round car trips made by locomotives	78,574	166,970 miles.
Total number of round car trips	3,555,574	7,555,595 miles.

Each car is moved by cable 2¼ miles in making one round trip.
Weight of each locomotive, 23 tons.
Number of locomotives in service, 6.
Number of locomotives in use during rush hours, 5.
Shortest headway between trains, 1½ minutes.
Total number of railway passengers carried, 224,077,923.
Total number of railway passengers carried for last 12 months, 39,890,205.
Largest number of railway passengers for one month—October, 1891—3,623,016.
Largest number of railway passengers for one day—April 30, 1889—159,259.
Total number of foot passengers to June 1, 1891, 28,171,839.
Largest number of foot passengers in one month—June, 1883—909,100.
Largest number of foot passengers in one week—the last week in May, 1883—668,456.
Largest number of foot passengers in one day—on May 27, 1883—163,000.

Progress of the Maryland Steel Company.

A correspondent of *Engineering* thus describes the recent visit of the members of the American Institute of Mining Engineers to the above works, at Sparrow's Point, near Baltimore:

This is really a part of the Pennsylvania Steel Company, and bids fair to be the largest part. That company having obtained an interest in the celebrated Juragua mines in Cuba, looked to a location for manufacture on tide water. They accordingly secured 1,000 acres about nine miles from Baltimore, in Chesapeake Bay, and have labored since 1887 to put it into shape, with most gratifying results, for they have probably one of the finest Bessemer works in the United States, while the outlook for the future is even more remarkable. The works have deep-water navigation, which not only brings their ore, but enables them to ship to all coast points and to South America at a minimum expense, and in addition they have constructed a railroad to Baltimore which gives them access to all interior points.

The manufacturing plant at the present time consists of four blast furnaces, of which three have been in operation, and the fourth is ready for work at any time, furnace C being the only one in blast at present; a Bessemer plant and rail mill; the marine department or shipyard, machine shop, pattern shop and foundry, partly completed and in operation. All the buildings and other improvements on the property have been placed here since the Pennsylvania Steel Company commenced operations in 1887.

Of the piers, No. 1, 40 ft. wide and 600 ft. long, was built in 1887; No. 2, finished in 1890, is 900 ft. long and 100 ft. wide. These piers, which will accommodate six steamers, are designed chiefly for the handling of cargoes of iron ore and for shipping the products of the works; they will be equipped with the most approved appliances for this work.

The four furnaces now built are each 85 ft. high and 22 ft. bosh. The blast is supplied by double vertical condensing engines, built from designs of the company. The blowing cylinders are 84 in. in diameter and 60 in. stroke, and steam is supplied by Babcock and Wilcox boilers, 4,000 horse power being allowed each pair of furnaces. There are four Whitwell stoves, 70 ft. high and 22 ft. in diameter, for the hot blast to each furnace.

The Bessemer plant is arranged to work either with direct metal from the blast furnace or with remelted metal from the cupolas, and is designed for four 18-ton converters. Along the line of the stock house electric cars are run on a depressed track to convey the stock barrows to the hoist, thus saving the labor of wheeling. A casting was made while the party was there. The moulds were placed in vertical position on cars specially designed for the purpose, and the ladle is hung over the cars, which are moved mechanically under it to be filled; hence a pit is not required, which seems a great improvement. The ingots are stripped by a double vertical stripper and taken to two blocks of pit-heating furnaces.

The blooming mill is of the "two-high" reversing type, with rolls 36 in. in diameter, driven by a pair of 42 in. by 60 in. reversing engines. Beyond the rolls is a hydraulic shear for cutting off the ends of the blooms. The blooms pass direct from the blooming mill table through the shear to the rail train, where they are rolled into rails without reheating.

The rail train is "three-high," with rolls 26 in. in diameter, driven by two 48 in. by 66 in. Porter-Allen engines. One engine will drive this in case less power is needed, and the train is fitted with tables for handling the bars from the different passes mechanically, and is arranged for turning out finished rails six lengths (180 ft.) each. The six-length rails are rolled on the lighter sections, the number of lengths being reduced as the weight of the section increases. The object is to keep the weight of the ingots uniform. Beyond the rail train are the sawing, straightening and drilling appliances.

In cooling, the rails do not touch each other. Hence there is little straightening required. In fact, one is impressed with the many devices to facilitate the work and to reduce the handling of the material to a minimum.

On that portion of the property lying east of the Bessemer and rail department an extensive plant of open-hearth furnaces is projected, the product of which will be distributed among the blooming mills, plate and structural shape mills to be erected in connection with them.

The marine department, although not complete in its varied details, is in active operation. On the fitting-out pier, alongside which vessels will be taken as soon as launched, to receive their machinery and outfit, is being erected a machine shop, also hoisting shears of 100 tons capacity. The other buildings comprise the tool shed, smith and machine shop, joiner and paint shop, and dry house. There are now completed four slips for vessels 250 ft. to 300 ft. long, others for larger vessels to be added as required. One steel seagoing tugboat has been recently completed and is now in active service; another is nearly finished. A side wheel steamer 210 ft. long and a propeller steamboat 305 ft. long, for the service of the Baltimore Steam Packet Company between Baltimore and Norfolk, are under way.

The machine shops, one section of which is now erected and partly in operation, are intended to produce the apparatus required for the extension of the manufacturing plant and the engines and other machinery required by the shipbuilding department. The present shop is one of three bays, of which the other two will be used as erecting and light tool shops.

In this building heavy castings for the works and for the vessels at the shipyards are being made daily and handled by hydraulic cranes, to be aided by a 50-ton electric traveling crane which is nearly completed.

A brick manufactory with a daily capacity of 25,000 is operated by this company, and on the property is located a lumber company manufacturing 250,000 ft. per day. The buildings have been constructed with a view to extension, and reflect the greatest credit on their designers. This inspection closed the day's excursion, and there was yet another trip to be chronicled, and that was to Indian Head on the day following, to see the United States proving grounds, to witness some tests. Shots were fired from the rapid-fire guns and from the 6-in. and 8-in. rifles. The 6-in. shot passed through a Carnegie 6-in. plate. The smokeless and cocoa powders were examined, and from thence the party visited the United States Navy Yard at Washington, to see the gun shops, and to admire the lathes and rifling machines for guns from 6 in. to 12 in. These guns were shown in various stages of completion, and the heart of the American citizen dilated with pride, and he felt almost like wishing for a war to show foreigners what an American gun can do when needed.

The arrangements for this meeting, it may be said in closing, were most carefully planned and completely carried out. The local committee covered themselves with credit and deserved all the thanks they received.

Their souvenir book giving an account of Baltimore, its industries, its geological characteristics, and accompanied by an excellent map of the city and a geological map of the section, was a work of care and was greatly appreciated. It will, undoubtedly, find a permanent place in the libraries of the members, and remind them that the Baltimore committee are men to be proud of.

A Kingdom in Ohio.

Zoar, O., is the abiding place of a mystic band of German communists who hold all property in common, the place being a miniature kingdom within itself. The people, who call themselves Zoarites, own 7,000 acres of land, which all lies in one body, about half of the tract being in a high state of cultivation. The original Zoarite purchase was 10,000 acres, but 3,000 have since been sold at a high figure. Every article, implement, device, contrivance or machine used, wrought with or employed in Zoar, is of Zoarite manufacture, and the same may be said of every article worn or eaten, with the exceptions of coffee, tea and spices.

The shoes the Zoarites wear are made by their own shoemakers from leather prepared by their own tanners, from hides taken from cattle bred and raised on the great community cattle farm. The coal which warms them and cooks their food is dug from their own mines, and is burned in stoves cast in their own foundry from iron smelted in their own furnaces from ore found in abundance on their own lands. They have community tailors, bakers, weavers, butter makers, cheese makers, and all other useful artisans and tradesmen. The tailor uses nothing but Zoarite cloth made by the Zoarite weaver from wool sheared from Zoarite sheep. The same may be said of the whole catalogue of manufactures, which certainly gives to Zoar distinctive characteristics unknown to any other American city or community.—*St. Louis Republic.*

THE WATER LILY HOUSE AT KEW.

This house, at the Royal Botanic Gardens, about six miles from Hyde Park, London, is at its best any time between the middle of July and the end of September. The Nymphæas occupy the whole of the large circular tank, with specimen plants of hedychiums, sugar cane, sagittaria, and clusia round the margin. The iron rail which encircles the tank is partly covered with the stems, leaves, and flowers of Batatas paniculata, and the narrow shelves against the sides of the house are covered with soil one foot in depth, in which a collection of tropical gourds is planted. The vine of the gourds is trained to wires running below the roof, and the effect of their large and sometimes bright colored fruits as they hang over the water lilies is particularly good. Along with the gourds grow such handsome flowering creepers as Solanum Wendlandii, the best of all tropical solanums, passifloras, ipomœas, Aristolochia elegans, A. ridicula, Clitoria ternata, Bignonia Tweedieana, Beaumontia grandiflora, Allamandas, etc. In tanks in the corners of the house are Nelumbiums, Cyperus papyrus, Amorphophallus campanulatus, and other large and remarkable moisture-loving plants. The collection of Nymphæas is a rich one, and we have counted, says the *Gardeners' Chronicle*, over a hundred expanded flowers in this tank on a July morning at about eleven o'clock, when the whole of the kinds are in "blow." Blue, purple, red, rose, white, and yellow colors are among them. The gourds comprise Luffas, including the Sooly Qua, L. egyptiaca, which has fruits five feet long, and which are shown in the picture; Lagenarias, such as L. gigantea and L. vulgaris, Cucurbita maxima, Cucumis sikkimensis, snake and adder gourds (Trichosanthes), the wax gourd, and numerous other kinds.

WATER LILY HOUSE AT KEW ROYAL BOTANIC GARDENS.

The house was built in 1853 for the Victoria regia, which was grown there until the present Victoria house was erected some twenty years afterward. Since then the "Old" lily house has been devoted to the Nymphæas, which do extremely well in it. Its dimensions are 44 feet square, with a porch on the south side. The roof is span, about 20 feet high in the middle, and the whole of the framework is of iron, resting on a thick stone base. It is an extremely light and, at the same time, a strong and elegant structure. The tank is circular, 36 feet in diameter, 2 feet deep, with a leaden bottom. Two rows of hot water pipes run through the water, and there are six rows of 4 inch pipes all around the sides of the house. The Nymphæas are grown in large pots, except N. zanzibarensis, which is planted in a circular brick bed in the center of the tank. The water is kept at a temperature of about 70° Fah. throughout the summer. The house is shaded with thin canvas blinds only in very bright weather in the middle of the day. These are, roughly, the essential conditions which produce the really delightful display of moisture-loving tropical vegetation represented in the woodcut.

The Battleship Texas.

The progress made for the past four years in adding cruisers, gun boats, and monitors, or harbor defense vessels, to our navy, has been highly gratifying, and there is no room for doubt that the great body of the American people now look with exceeding satisfaction upon the highly efficient fleet of modern war vessels which we at present possess. The building of battleships proper, however, has been a slower work, such vessels, according to the most recent method of classification, being designed to carry guns of the heaviest caliber, and be protected by an armor which will resist the projectiles of similar guns on an enemy's vessels. The launch of the battleship Texas, therefore, at the Norfolk Navy Yard, on June 28, attracted wide attention, forming a subject of pleasant comment by the press generally throughout the country, without regard to politics, while the launch itself was witnessed by some twelve thousand persons.

The original plans of the Texas were made by English designers, but they have received so many successive alterations that but little has been left of the special features at first contemplated. She will be a steel-armored twin-screwed vessel, of 6,335 tons normal displacement, driven by two sets of triple expansion engines, capable of developing 5,800 horse power with natural draught and 8,600 with forced draught.

The vessel will be 290 feet long, 64 feet 1 inch broad, and have a mean draught of 22 feet 6 inches when carrying about 500 tons of coal, with a bunker capacity for 450 additional tons. The main armament will consist of two 12-inch breech-loading guns, each weighing 46⅓ tons, mounted in two turrets *en echelon*, one being on the starboard side aft, the other on the port side forward. The secondary battery will consist of four six-pounder and four three-pounder rapid-firing guns, with four 47 mm. Hotchkiss guns, all mounted on the gun deck behind 1½-inch plating, two Gatling guns, and two 37 mm. Hotchkiss guns, mounted on the bridge, the same in the military tops, and two three-pounder rapid-fire guns on the flying bridge. There will be six torpedo tubes, one in the bow, one in the stern, and two on each side; a strong ram bow adding to her offensive powers.

The turrets will be armored with twelve inches of steel and their bases inclosed by a diagonal redoubt armored with 12 inches of steel, which also will protect the hydraulic machinery for working the guns, and the smoke pipe casings. A belt of steel armor 12 inches thick, extending 2 feet above the designed water line, 4½ feet below it, and 116 feet in length, will protect the boilers and engines. A protective deck of 12-inch steel will be laid above the armor belt. Beyond this belt it will be inclined toward the extremities and sides, and will be 3 inches thick on the slopes. At the ends of the belt will be diagonal armored bulkheads of 6-inch steel, pointed toward the bow and stern, whose oblique surfaces will afford additional protection.

The hull is of steel throughout, and built on the cellular system. A double bottom extends under the engines, boilers, and magazines, and is divided both longitudinally and transversely into numerous watertight compartments. There are 129 of these compartments, all connected to steam and hand pumps by an extensive drainage system, thus minimizing the disastrous effects of the ram and torpedo. The boilers and engines are to be in six water-tight compartments below the protective deck, three on each side, with a central passage providing protective communication between the extremities of the ship. Above the turrets will be a flying deck for navigating the ship, on which boats are stowed. Two second-class torpedo boats will be carried in addition to the usual complement.

The ship will be lighted throughout by electricity, and will carry two powerful electric search lights and two smaller search lights for boat use. She will be used as a flagship, and will carry a complement of 368 officers and men, her spacious decks affording much greater accommodation and comfort for the crew than is possible on cruisers. Her machinery is being built by the Richmond Locomotive and Machine Works, of Richmond, Va., but will be placed on board at the Norfolk Navy Yard.

Aside from the delay in the construction of the vessel from the changes found necessary in her plans, far more time has been required for the work from the fact that the Norfolk Navy Yard, which was selected as the place of building, was but poorly supplied with the required facilities for the construction of so large a vessel. Large additions have, however, been made to the plant and equipment at this yard, thus affording additional facilities for the building and repair of war vessels in the future.

Compressed Air Locomotive.

The *Street Railway Review* describes as follows a compressed air locomotive that is reported to have been successfully used for several months in the interior of the old Eagle Mines, near Pittsburg. This locomotive was built by H. K. Porter & Co., of Pittsburg.

Generally the construction is the same as a steam locomotive, with the omission of the boiler and water tank, these being replaced by two large cylindrical tanks holding the compressed air. These tanks are 36 inches in diameter and 16 feet long. The connection of the air reservoir with the cylinders is simple, and no difficulty is experienced from freezing either in summer or winter. The locomotive carries air at 500 to 600 pounds pressure, but ordinarily the pressure varies from 250 to 450 pounds.

In the mine where the locomotives run, the grades are varied. The largest up-grade is 1,200 feet at 1½ per cent, but varying to 5 per cent. Curves average 25 feet radius, but 17 feet are successfully rounded. An ordinary day's work of 20·5 miles, or thirty-one round trips, does not develop more than half the power of the motor. Over the longest entry up maximum short grades of 5 per cent from eight to eleven cars are hauled each trip, the weight of the car being 1,250 pounds and of the load 3,360.

The average charge of air doing this work was 334 pounds, running the pressure down 193 pounds and having 141 pounds pressure left at the end of each trip.

The air is compressed by a Norwalk compressor (made by the Norwalk Iron Works, of South Norwalk, Conn.), and situated for convenience 2,400 feet from the charging point of the engines. No loss of pressure is noticeable, although the air is conveyed through 3 inch pipes. The time for charging is one minute.

If charged to 500 pounds, the engine can make a distance of 1½ miles, doing heavy work, and it is practicable to make a running capacity of 4 miles with one charge. The compressed air locomotive is peculiarly fitted for this work, inasmuch as the narrow quarters, short curves, presence of fire damp, water seepage, and ventilation require a motor fulfilling most difficult conditions. The air locomotives are built in various sizes of cylinders, from 5 to 10 inches in diameter. The smaller sizes will run on 16 pound rail in 4 foot entries. The larger sizes require 20 to 30 pound rail and 4½ foot entries.

Straw Bleaching.

Place the straw in tubs of whitewood, pour over it hot water, and allow it to stand for 24 hours. Pour off the water and run in a lye made from 1 pound potash in 3 quarts of water, and after standing a short time in this, place in a boiler and boil up for 9 hours, adding water from time to time to make up for that which is lost by evaporation. Wash well with water, give another boil in lye of half the strength of the last, and wash well. Then prepare a liquor of chloride of lime (bleaching powder) of 1 to 2 degrees Tw.; pour this over the straw, and allow it to stand for 24 to 36 hours, or until it is perfectly bleached. Rinse the straw well in several waters, and expose it to air until all traces of chlorine have disappeared. The straw is then ready for use.

RECENTLY PATENTED INVENTIONS.

Engineering.

FIRE ENGINE PUMP.—Truckson S. La France, Elmira, N. Y. A double-acting upright pump is, by this invention, provided with a novel casing and arrangement of the inlet and outlet passages with the pump barrel, double sets of valve chambers being arranged in the front or accessible side of the pump casing and closed by separate lids, with all the valves grouped in close relation with each other, and so that either end sets of valves are readily accessible without disturbing the end covers of the pump barrel and its casing. The valves and interior mechanism are thus made conveniently accessible when repair or adjustment is necessary. The invention also includes a solid head and bucket plunger.

BRIDGE.—Thomas H. Kosure, Farmersville, Texas. A suspension bridge, in which the principal members are constructed of wire cables under tension, is provided by this invention, the cables being made of straight strands of wire twisted at the time the bridge is constructed. The cables are run back and forth from one anchorage point to a turnbuckle until enough strands are laid for a cable for one section, and from that turnbuckle the strands are then laid to the next for the next section, etc., the screw-eyes of the turnbuckles being finally turned in opposite directions to twist the strands and tighten the cable between its anchorage points. The improvement is mainly designed for use in building small, light and strong bridges for public roads, etc.

SMOKE CONSUMING FURNACE.—Edward Cartwright, Wilbg, Neb. This furnace has an outlet flue, curved from the side walls of the fire box through a horizontal arc of ninety degrees, and having greater vertical depth along the outer or longer arc than it has along the inner or shorter arc, the peculiar shape and arrangement of this discharge conduit making available the effects of reflection and concentration of heat in a manner designed to completely consume the smoke without the aid of a blast. This furnace is designed to be especially useful in heating steam boilers in smelting and other metallurgical operations.

Railway Appliances.

CAR AND HOSE COUPLING.—John H. Carroll, De Smet, South Dakota. This is a combination device in which the hose coupling for the air brake is united with an improved car coupling, the coupling together of two cars simultaneously effecting a coupling of the hose sections on the coupling heads. The car coupling head is pivoted to swing laterally and connect with a mating coupling head, while a hose coupling half section is positively held upon the car coupling head, and movable into position to couple in response to a corresponding movement of the car coupling head, being adapted to couple with a mating hose coupling section of the opposing car.

Mechanical.

DRIVE CHAIN.—West Dodd, Sac City, and Arthur T. Martin, Clinton, Iowa. The link of this chain has a hook at one end and an eye at the other, with radial flanges at the ends of its shank near the hook and eye. A chain made with these links is designed to be perfectly flexible, making a secure driving connection with the wheel or wheels, around which it may be passed in any direction. The chain can also be crossed to reverse the motion of the shafts, and can be conveniently used to connect wheels or pulleys at any desired angle by means of loose guide wheels or idlers.

EQUALIZING LINKS.—Thomas Murphy, Sewickley, Pa. This invention provides a method of and apparatus for equalizing the members or links used in deep well drilling machines, etc., to prevent the links from breaking when subjected to a heavy strain or sudden jerk. The lengths of two sides of a link are equalized by subjecting two connected links to the action of heat and at the same time straining the links apart until the two sides or members are of equal lengths, and then permitting the links to cool while under strain, the heating and stretching process being continued until the reins of each of the jars are of the same length.

WATER MOTOR.—Benjamin S. Partridge, Jacksonville, Fla. This is a device adapted for attachment to artesian wells, and designed, with a low pressure of water, to afford a high degree of power. Opposing cylinders, with pistons connected by a power rod, are arranged opposite spaced valve chests in which are oscillating valves connected with a spring-pressed and longitudinally movable rod operated from the power rod, there being spring catches for temporarily locking the valves, and means for operating the catches from the spring-pressed rod. The invention also includes various other novel features.

MACHINE FOR CARROTTING FUR.—John H. Sanders, New York City, and James E. Carlin, Brooklyn, N. Y. This is a simple and rapidly operating machine adapted to fit furs for use in hat making more perfectly than the work can be done by hand, and which is also constructed to deliver a fine spray of the carrotting liquid upon the fur and save the surplus solution, so there will be no waste. The machine comprises a pair of feed rollers, adjacent to and parallel with which is a revoluble brush, an atomizer delivering between the brush and rollers, and a blower connected with the atomizer.

PUMP.—Robert H. Raprager, Lakota, North Dakota. All the pumping parts of this pump are designed to be below the surface of the water, and thereby be protected from freezing, the improvement being especially designed for double-acting pumps for use in a cold climate. The pump is very simple in construction and easy in operation, and has two plunger barrels connected with each other at their bottoms, inlet and outlet valves being arranged in the upper ends of the barrels, there being an outlet pipe formed with a casing, into which discharge the outlet valves, various other novel features being also included in the invention.

CLAY CONDUIT MACHINE.—James J. Powers and Robert Van Buren, New York City. The economical working of clay conduits for electrical wires and other uses is the purpose of the machine provided by this invention. The machine has a power cylinder, below which is a moulding cylinder, the pistons in the cylinders being connected, while a spider is locked to the lower end of the cylinder by a bayonet joint, there being means for releasing the spider by the descent of the pistons. An inclined filling cylinder, in which is a follower, communicates with the moulding cylinder. Longitudinal passages of the electrical conduit are formed in the compressed clay, which, when discharged from the moulding section, only requires drying, baking and glazing, to make a perfect conduit section.

WOOL WASHING MACHINE.—Walter T. Forbes, Atlanta, Ga. A box-like receptacle, with a feed opening at one end and discharge openings in the bottom of its opposite end, has suspended in it a perforated trough with discharge portions projected through the discharge openings in the box. A conveyer is journaled in the trough, to convey the wool from the feed end to the discharge end, there being also a spray pipe connected with a scour-holding tank, and the apparatus is designed to quickly and effectively separate dirt and greasy matter from wool without injuring it.

Agricultural.

POTATO DIGGER.—David Livingston, Thornville, Ohio. This machine has a shovel of novel construction, which, as the machine is drawn over the ground, clears itself in all kinds of soil, whether wet or dry or weedy, and enables the operator also to conveniently cut off weeds and tops and roots. The shovel lifts the potatoes with the dirt in such a way that the dirt loosens and falls away and the potatoes are left on top of the ground in a convenient position for the picker.

HAND CULTIVATOR.—Tyree T. Rodes, Paris, Mo. This is an implement of very light and simple construction, which can be operated to close its jaws or to open them any desired distance to cultivate at each side of small plants. The teeth are rigidly secured to the two jaws, which are opened and closed by a handle, and the teeth are long, sharp and hook-shaped at their outer ends. In spreading or opening the jaws, they open with mathematical precision, and the implement is very compact.

STOCK FEEDING RACK.—Henry G. Chamberlain, Ridgeway, Wis. This is an improved rack designed for use in the stable, or in the pasture or farm yard, for feeding grass, fodder, grain, roots, etc., permitting the stock to feed readily and at the same time preventing any waste. Sliding gates regulate the quantity of feed passed to the feed troughs, the gates being adjusted according to the nature of the material fed, while the arrangement is such that none of the feed is liable to be drawn out or dropped upon the ground. Continuations or extensions of the roof of the rack are also provided for as a protection to the stock from the sun and rain.

MILK COOLER.—Samuel W. Tobey, Fairfield, Neb. A tank is centrally arranged within a double-walled box having suitable covers, an inlet pipe having its inner end arranged transversely in the tank bottom and provided with a series of holes, while its outer end is provided with a funnel, there being discharge and overflow pipes leading from the tank, through which running water is allowed to pass. Provision is made for a free circulation of air around the tank, and there is no chance for impure air to come in contact with the milk or cream, while the milk is cooled from the bottom toward the top, thus insuring the rapid rise of the cream.

Miscellaneous.

SWING JOINT FOR BRACKETS.—Henry P. Drew, New York City. This is a cheap, substantial and shapely swing joint connection for gas pipes, adapted to pass a large volume of gas, and which may be readily converted into an electrically insulated swing joint for use where electric lights are combined with gas fixtures. It has two capped sections with branches perforated and threaded to receive pipes, and further perforated to connect the threaded perforations with the capped cavities of the joint sections, a headed coupling bolt loosely engaging one joint section and locked to the other joint section, a washer between the joint sections and one under the coupling bolt head, a clamping screw bolt, and a washer between the locked joint section and the head of the clamping screw bolt.

MINER'S LAMP.—Julius R. Watts, Springfield, Ill. This lamp has a spout provided with a wick raiser, and there is a guide between the spout and the body of the lamp, a wick-retaining device having an opening at its lower end freely embracing the spout and its base, and extending upward and outward through the guide to the upper edge of the spout. The lamp is simple, durable and inexpensive, and the miner can, without removing the lamp from its support, quickly and conveniently raise and lower the wick, to increase or diminish the light.

BALANCED STAGE.—Maurice Richter, Williamstown, W. Va. A gang plank, or balanced stage for ships, is provided by this invention, and one which can be easily operated by a single person, the main portion of its weight being supported by a spring mechanism upon the ship. A counterbalancing spring is arranged within a post, at the upper end of which is a sleeve carrying the tubular shank of a bracket on which is a pulley, a boom from the post also carrying a bracket and pulley, while the gang plank is connected by a rope with the balance spring. The tension of the spring is such that it nearly balances the weight of the gang plank, and but little manual force is required to raise or lower it.

CRADLE.—James H. and George W. Meek, Denison, Texas. This cradle is suspended from its supporting frame in such a manner as to render it capable of vertical, lengthwise and sidewise movements, the cradle being given an easy, uniform and steady motion without the danger of tilting over. The construction is such, also, that the frame may be folded up to be set aside without the necessity of removing the cradle from the frame or detaching any of the parts.

NAILLESS HORSESHOE.—James McCaffrey, Philadelphia, Pa. A spring splice plate is riveted to and connects the front end of two clip plates, clamping arms being connected to the rear ends of the clip plates, connected by a screw and nut, in connection with detachable wearing plates. The improvement dispenses with the work of blacksmiths in shoeing horses, and avoids the necessity of driving nails into the horse's hoof.

DEVICE FOR ASCERTAINING GRADES, ETC.—David C. Wolfe, Lyons, Kansas. A hollow case is provided with angle irons at the corners and spring clasps, in combination with a reversible base board bearing upon one side a set of graduated plates and scales, and having pins projecting in central position from the ends, there being also an adjustable carrier with graduated lever or rule. The improvement is designed to furnish an accurate and ready calculator in railroad work of the position and height of bed and slope stakes, and of the cubical contents of a cut or fill where the surface is level or has a regular and even slope.

DITCHING MACHINE.—John Cornelius, Oakland, Md. This is a simple and inexpensive machine, which may be used to cut ditches with parallel sides or with sides flaring outward, the machine being readily held at the desired depth in the ground, and prevented from running out or going in too deep. It has a sole piece in which is a base cutter, a central cutter held between the base beams, with side cutters, a partition plate, and turning wings, the dirt being equally divided and thrown half on each side. The machine may be pulled by a stump-pulling machine or other suitable pulling or power mechanism.

TO OPEN AND CLOSE COCKS, ETC.—Oscar Loewe, Berlin, Germany. This invention provides a means for opening and closing gas taps, valves, the switches of incandescent lamps, etc., those which are ordinarily inaccessible being thus readily operated. It consists of a tubular key turner with a projecting arm, a rod extending through the body, and having at its lower end a handle, an inclined shaft journaled in the arm, bevel gears connecting the shaft and rod, and a key engaging a clip on the shaft. Connected with the device is a short tube containing igniting material, which may be used when the device is employed to turn on and light a gas jet.

HORSE COLLAR.—John B. Mueller, Streator, Ill. Two depending bails or links are provided at opposite sides of the upper end of the collar, a pad being pivotally connected with the lower ends of the bails, an easily operated coupling for the common form of horse coupler being also provided, whereby the two members of the collar may be secured together and held the desired distance apart. The pad is so connected with the collar that the movements of the latter will not be transmitted to the pad, which will lie still upon the neck of the horse.

WATER STILL.—Johannes Petterson and Louis H. Liebeck, New York City. In this apparatus a water tank having a filter is connected with a source of supply, and a boiler having a steam dome has a pipe connection with the filter, a steam filter being connected with the steam dome, and a cooling cylinder held within the tank, the cylinder having its upper end connected with the steam filter and its lower end provided with a discharge pipe. The apparatus is designed to distill a large and continuous supply of water, which is rapidly converted into steam, and the steam filtered and condensed, finally issuing in the form of pure water, for either drinking or medicinal purposes.

WHITE LEAD CORRODING PIT.—William H. Wetherill, Philadelphia, Pa. This invention provides an improvement in pits used for corroding lead, where the lead is placed in layers alternating with layers of wet, fibrous material, the heat generated in the process producing a column of heated air in a ventilating shaft, and causing fresh air to be drawn in through side pipes leading to the surface of the ground. These side pipes are embedded in the surrounding earth, and the fresh air thus supplied creates a rapid circulation, thus hastening the process.

MUSIC RACK AND STAND.—Henry W. Potter, Wellington, New Zealand. This is a folding rack with telescopic stand, the invention providing an article which, when not in use as a stand, may be made to assume the shape of and be employed as a walking cane, means being also provided whereby the rack may be quickly and conveniently spread for use and adjusted to the desired height. The device is simple, durable and light, and can be readily manipulated.

HORSESHOE.—John E. Jarvis, London, England. This is a combined metal and rubber horseshoe, in which the India rubber is combined with the metal in such a way that the weight shall be principally borne by the wall of the hoof, and the rubber, held in place by the metal shoe and its fastenings, constitutes an integral part of the wearing surface of the shoe, the sole of the foot being either uncovered or so far covered as to bring a part of the weight on to the frog. The improvement is designed to promote lightness and elasticity of tread, prevent slipping, cutting and clicking, protect the heels and feet from undue pressure, and obviate capped elbows.

SMOKE EXCLUDING HOOD.—Christian Herlick, Marquette, Mich. Firemen and others about to enter a burning building may protect themselves from the flame and smoke by the use of this device, which is a light and readily applied structure, permitting the wearer to see, and provided with means of obtaining air for breathing from the floor, below the level of the smoke. The hood has a pendent glazed door in front, air supply pipes supported by the frame bars, and an apertured bottom piece, below which drop hinged doors. A fire-extinguishing apparatus may be carried upon the back, attached to the shield or hood.

TILL LOCK.—Hugo Brav, Berlin, Germany. Connected with the lock provided by this improvement is a device whereby the drawer to which the lock is applied may be opened by pressing with the foot on a foot lever, the movement of which is transmitted by a combination of levers to the drawer. The lever normally holds the drawer closed, so that it cannot be opened by a person at the side or front of the counter, and a hand inserted when the foot is not on the lever would be caught or jammed in the drawer.

ILLUMINATED ADVERTISING SIGN.—Charles R. McGimsey, New York City. A casing and illuminating mechanism are provided by this invention, designed to emit a steady or an intermittent light as desired, the stencil advertisement or notice to be backed with transparent colored and movable material, the latter having a backing of translucent material, whereby the matter upon the stencil will appear in illuminated colors without disclosing the mechanism within the casing. If the light is to be intermittent, a spring motor is preferably employed, the circuit of the light being then alternately opened and closed.

WOODEN PIPE.—Archie McL. Hawks, Tacoma, Washington. A new article of manufacture is afforded by this improvement, consisting of a pipe tube formed of staves, for use as conduits and for like purposes, the staves having transverse dovetailed grooves in their ends, the opposing grooved ends being united by double dovetail blocks fitting the grooves and serving to maintain the ends of opposing staves in close contact. The staves are tightened by bands, and the pipe is designed to have great strength and durability.

REGISTERING TOY BANK.—William R. Christie, New York City. This invention affords an improved bank of simple construction, into which coins of any predetermined denomination may be introduced, and the amount of coins placed in the bank be indicated by suitable dials, a gong or bell being sounded as each deposit is made. The construction is such also that the bank can be opened only when a predetermined amount has been placed in it, or it may be made to open at any time desired.

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Minerals sent for examination should be distinctly marked or labeled.

(4455) **J. F. M. writes: Will you please** explain the art of decalcomania? A. Decalcomanies or chromo transfer prints are made by brushing thin plate paper with flour or starch paste. When dry the paper is treated with a solution of gum or gum and starch. When dry it is well rolled. The printing is done on this paper by lithography, but the colors are worked in reverse order, the transparent colors being printed first. Either the surface of the print or the surface on which it is applied must be brushed with copal varnish. Apply, and remove the paper by sponging.

(4456) **H. W. S. says: When was the** first railway introduced into the United States and England, and also who built the first locomotive and where did it run in America? A. Railways were introduced in England, September 27, 1825; in Austria, September 30, 1828; in France, October 1, 1828; and in the United States, December 28, 1829. The first locomotive which ran in America was built at Stourbridge, England, and was imported for the Delaware and Hudson Railroad.

(4457) **G. M. F. says: What employment** is considered to be the healthiest and what the most unhealthy, or in other words, what class of people live the longest? A. The average ages for a few occupations are as follows: Judges, 65; farmers, 64; clergymen, 56; lawyers, 54; merchants, 51; tailors, 44; editors, 40; machinists, 36; teachers, 34; clerks, 34; operatives, 32.

(4458) **B. C. W. says: A number of** years ago I saw a table in your paper giving the average number of days of sickness that could be expected by people of average health at different ages. Can you give this table? A. At 20 years of age calculate on 4 sick days yearly; at 20 to 30, 5 or 6 days; at 45, 7 days; at 50, 9 or 10 days; at 60, 16 days; at 65, 31 days; at 70, 74 days.

(4459) **B. C. S. says: Kindly give the** height of the ten highest towers and steeples of the world. A. Eiffel tower 1,000 feet, Washington monument 555, Cologne Cathedral 511, Hamburg, St. Nicholas 473, Strassburg 468, Rouen, Notre Dame, 465, Rome, St. Peter's, 455, Cairo, large pyramid, 450, Vienna, St. Stephen's, 449, Cairo, second pyramid, 446.

(4460) **W. A. R. asks how to give a** bright brass wheel the appearance of old bronze. A. A simple way is to wash the article with vinegar, and expose it to the vapor of ammonia, and repeat this until satisfactory, or boil it in a solution of copper nitrate, or immerse it in a solution of iron nitrate and hyposulphate of soda in 8 parts of water.

(4461) **I. A. wants a very deep black, and** has been informed that Frankfort black is the blackest of all. He cannot obtain it, and asks how it is made. A. It is made in Germany, from the vine branches and other refuse of the vine culture, like charcoal is made from wood. There is, however, a better black now, the aniline black, about which draughtsmen agree that it is the blackest black known.

(4462) **B. M. wishes to know what is** used to make woven textures uninflammable. A. The best is to wash them in a solution of sodium tungstate, next to this is ammonium phosphate, also calcium acetate and calcium chloride, equal parts dissolved in twice their weight, of water; also solution of alum, of borax, sodium sulphate, and boracic acid, or a mixture of the last four have been recommended, as preventing change of color, and not stiffening the texture after drying.

(4463) **J. B. asks for the best mixture** used to protect iron machinery exposed to the atmosphere. A. 1 part pulverized graphite, 1 part lead sulphate, and 1 part zinc sulphate, rubbed up together and mixed well with 16 parts of linseed oil varnish and then boiled, form a coating which no water will wash off, and proves a reliable protection for all kinds of oxidizable metals, in all kinds of exposure to weather.

(4464) **R. S., of New York, asks the simplest** way to test if the ground combination coffee consists of a mixture of different kinds of coffee only or contains adulterations, such as burned sugar. A. When he mixes the coffee with cold water, and lets it stand for half an hour, he will find the burned sugar at the bottom, while pure coffee will float on the top. He will find that most all the so-called combination coffees are in fact adulterated coffees.

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AND EACH BEARING THAT DATE.

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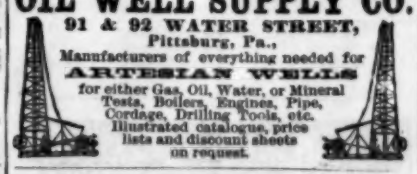

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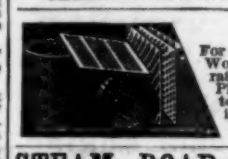

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Particulars of competition and further information can be obtained from the undersigned.

W. S. GORE,
Deputy Commissioner of Lands & Works.
Lands and Works Department,
Victoria, B. C., 16th June, 1892.

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NOTICE TO CONTRACTORS.

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C. D. BLANTON, Mayor.
B. M. LEE, City Eng.

U. S. ENGINEER OFFICE, CUSTOM HOUSE, CINCINNATI, OHIO, July 11, 1892.—Sealed proposals for furnishing cement, lumber, tie rods and washers required for lock and movable dam No. 6, Ohio River, near Beaver, Pa., will be received at this office until 2.30 p. m. August 1, 1892, and then publicly opened. Specifications, blank forms and all available information will be furnished on application to this office.

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